S 152

Stacks

LUTON
PUBLIC LIBRARIES.

CENTRAL REFERENCE LIBRARY.

Abstract of Rules and Regulations

The Reference Library is open every week-day from 9 a.m. to 9 p.m.

Readers must return the books consulted into the hands of the Librarian or his assistants, and must not replace the books taken from the shelves. No books may be taken from the Reference Library.

Illustrations may be copied, but not traced. The use of ink is permitted only at certain tables, which are reserved for the purpose.

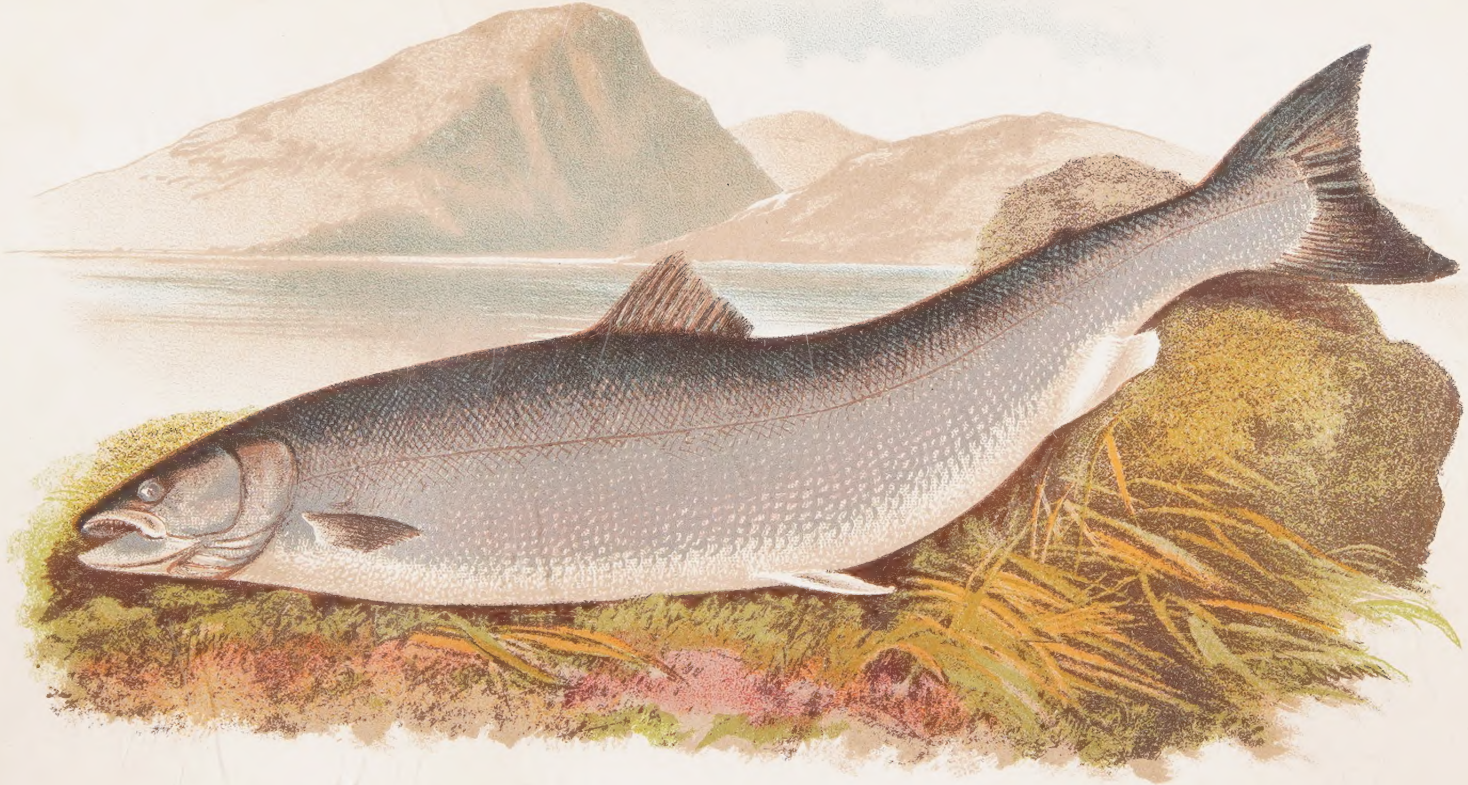
No person is allowed to use the Reference Library who is disorderly, intoxicated, or in an uncleanly condition. Letter writing or the transaction of business is not permitted.

Readers are requested to use the books with the greatest possible care, and to observe the general rules and regulations made for the comfort and convenience of readers.

Digitized by the Internet Archive
in 2025

https://archive.org/details/sportingfishofgr0000hcho

THE SPORTING FISH OF GREAT BRITAIN



THE SALMON (*Salmo Salar*)

To face Title page

THE

SPORTING FISH OF GREAT BRITAIN

WITH

NOTES ON ICHTHYOLOGY

BY

H. CHOLMONDELEY-PENNELL

LATE HER MAJESTY'S INSPECTOR OF SEA FISHERIES

AUTHOR OF

"Salmon and Trout," "Pike and other Coarse Fish," "The Modern Practical Angler," "The Angler-Naturalist," "The Book of the Pike," &c. Editor of the late "Fisherman's Magazine and Review."

ILLUSTRATED BY SIXTEEN LITHOGRAPHS OF FISH IN GOLD, SILVER, AND COLOURS.

LONDON

SAMPSON LOW, MARSTON, SEARLE, AND RIVINGTON

CROWN BUILDINGS, 188, FLEET STREET

1886

(All rights reserved)

094

CHISWICK PRESS:—C. WHITTINGHAM AND CO., TOOKS COURT,
CHANCERY LANE.

PREFATORY NOTE.

THIS attempt to represent the principal fresh-water fish of the British Islands, at least approximately in their actual forms and colours, may not, perhaps, be unwelcome to lovers of Natural History.

The Chapter on the Outlines of Ichthyology will, I hope, be useful to Anglers and students.

To the author of Yarrell's "British Fishes," as also to Mr. J. Van Voorst, the publisher of that excellent and exhaustive treatise, I gladly take this opportunity of acknowledging my many obligations.

H. C.-P.

LIST OF ILLUSTRATIONS OF FISH.

PAGE

THE SALMON 1
THE BULL TROUT 32
THE SEA TROUT 37
THE COMMON TROUT 47
THE LOCH LEVEN TROUT 52
THE GREAT LAKE TROUT 58
THE GRAYLING 62
THE PIKE 69
THE PERCH 86
THE CARP 94
THE TENCH 108
THE BARBEL 116
THE BREAM 122
THE ROACH 128
THE RUDD 132
THE DACE 138
THE CHUB 140
THE BLEAK 144

THE SALMON.[1]

UNTIL within the last fifty years very little was known of the natural history of the Salmon, the united lore of those most interested in the fisheries amounting to little beyond the fact that the fish ascended the rivers to spawn during the spring and summer —spawned—and descended again to the sea within the following two or three months.

Since the period referred to, however, and especially during the last two or three decades, the researches of ichthyologists and the experiments which have been conducted on a large scale by enterprising and scientific men have thrown a flood of light upon the subject, converting doubts into certainties, theories into practice, and generally advancing our knowledge of the subject to a point which has already produced practical results of great importance in the re-stocking of our ex-

[1] *Salmo salar. Salmo*, Lat. for a salmon; *salar*, from the Latin *salarius*, of salt.

hausted salmon rivers, and the increase of a valuable article of the national food-supply.

I may perhaps be permitted to refer with some satisfaction to my own small share in bringing about the legislative reforms to which the present material prosperity of our fisheries is of course primarily attributable. It is now some years, since, in an article on this subject in the *Saturday Review*, it was stated, "Mr. Pennell, Mr. Buckland, and a few others, have worked hard in the cause of the Salmon, in spite of territorial apathy, and if we are ever again to have this fish as plentiful as it was in the days of the mythical apprentices, it will be mainly owing to their exertions."

The following sketch, which I originally published in the *Times*, gives in a summarised form the history of the Salmon as it was then known. It cannot, I think, be said that subsequent experiments and investigations have in any material point added to or taken from it.

Proved Facts in the History of the Salmon.

1. Salmon and Grilse invariably spawn in fresh water if possible,—both the eggs, and the young fry whilst in the Parr state, being destroyed by contact with salt water.

2. The eggs are usually deposited on gravelly shallows, where they hatch in from 80 to 140 days,

according to the temperature of the water. Eggs remaining unhatched beyond the latter period will seldom hatch at all, possibly from having been destroyed by the low temperature.

3. The eggs deposited by the female will not hatch under any circumstances unless vivified, after exclusion, by the milt of the male; and—at least up to the period of migration—there is no difference whatever in fry bred between Salmon only, between Grilse only, between Salmon and Grilse, between Salmon and Parr, or between Grilse and Parr.[1] The female Parr cannot spawn; but the male Parr possesses, and constantly exercises, the power of vivifying Salmon and Grilse eggs.

[*Note*[1].—This is to be understood as referring to the specific characteristics of any of the Salmon thus bred. It seems very probable that there may be in fry variations of size or development depending on their parentage or generation, as there are also known to be differences in the size of the eggs of different breeding fish dependent upon the size and age of the latter.]

4. The fry remain one, two, and, in some cases, three years in the rivers as Parr before going down to the sea,—about half taking their departure at one year, nearly all the others at two years, and the remainder (which are exceptional) at three years old.

5. All young Salmon-fry are marked with bluish

bars on their sides until shortly before their migration, up to which period they are Parrs; they then invariably assume a more or less complete coating of silvery scales and become Smolts,—the bars, or Parr-marks, however, being still clearly discernible on rubbing off the new scales.

6. The young of all the species here included in the genus *Salmo* have at some period of their existence these bluish bars; and consequently such marks are not by themselves proofs that fry bearing them are the young of the true Salmon (*Salmo salar*).

7. Unless the young fish put on their Smolt dress in May or early in June, and thereupon go down to the sea, they remain as Parrs another year; and without Smolt scales they will not migrate, and cannot exist in salt water.

8. The length of the Parr at six weeks old is about an inch and a half or two inches; and the weight of the Smolt before reaching the tidal wave from one to two ounces.

9. In at least many cases, Smolts thus migrating to the sea in May and June return as Grilse, sometimes within five, generally within ten weeks, the increase in weight during that period varying from 2 to 10 lbs., the average being from 4 to 6 lbs.;

and these Grilse spawn about November or December—go back to the sea—and (in many cases) re-ascend the rivers the next spring as Salmon, with a further increase of 4 to 12 lbs. Thus, a fish hatched in April, 1854, and marked when migrating in May, 1855, was caught as a Salmon of 22 lbs. weight in March, 1856.

10. It appears certain, however, that Smolts do not always return during the same year as Grilse, but frequently remain nine or ten months in the sea, returning in the following spring as small-sized Salmon.

[*Note.*—It will thus be seen that the fry of the Salmon are called *Parrs*, or Parr, until they put on their migratory dress, when they become *Smolts* and go down to the salt water; *Grilse* if they return during the first year of their migration; and at all other periods *Salmon.*]

11. It has also been clearly proved that, in general, Salmon and Grilse find their way back to spawn to the rivers in which they were bred—sometimes to the identical spots,—spawn about November or December,—and go down again to the sea as "spent fish," or "Kelts," in February or March,—returning, in at least many cases, during the following four or five months as "clean fish," and with an increase in weight of 7 to 10 lbs.[1]

[1] Shortly before spawning, and whilst returning to the sea as Kelts, or spent fish, Salmon are unfit for food, and their capture

This, in a condensed form, is at the present time as it was when first published—a fair statement of our positive knowledge as regards the leading facts in the history of the Salmon; and it may be doubted if any subsequent discoveries—however they may add to or amplify—will be found to materially modify them. In "Fact, No. 10" will be found the first statement of the now very generally admitted theory of a double or divided migration.

The several species belonging to the genus *Salmo*, and properly coming within the scope of these pages as British Sporting Fish, may be broadly divided into three groups :—

1. The Silver, or Migratory species (*i.e.* those migrating to or from the sea);

2. The Yellow, or Non-migratory species; and,

3. The Charrs, or Orange- and Red-coloured species;

the general colouring of the first being always more or less greyish-silver, that of the second golden or yellow, and that of the third, espe-

is then illegal. "Foul fish" before spawning are, if males, termed Red fish, from the orange-coloured stripes with which their cheeks are marked, and the golden-orange tint of the body; the females are darker in colour, and are called Black fish. After spawning the males are called Kippers, and the females Shedders or Baggits.

cially on the under part of the body, crimson and orange of various degrees of brilliancy. The species of the Silver, or Migratory group, are three in number; which include, according to the opinions of ichthyologists, the whole of our migratory *Salmonidæ*, under whatever local names they may occur:

The true Salmon (Parr, Smolt, Grilse) *Salmo salar*:

The Bull-Trout, also called Grey Trout, Sewin, and Roundtail—*Salmo eriox*; and

The Sea-Trout or Salmon-Trout (sometimes also called White Trout)—*Salmo trutta*.

In the few further observations which limits of space permit of my offering on the general history of the true Salmon (*Salmo salar*), I shall adopt the sequence suggested by its natural habits, as likely to be that most easily followed and most convenient for reference. Thus, commencing with the ascent of the fish in the early spring and summer, its course will be briefly sketched from the tidal wave up the river to the spawning-ground, and back again to the sea,—the gradual changes of colour and condition being at the same time pointed out. Returning then to the spawning-beds, where the ova should be approaching the

time of hatching, the growth and habits of the young fry will be traced from the egg until their migration to the salt water as Smolts; their subsequent return as Grilse; and, finally, as Salmon.

Ascent of Salmon from the sea: fresh-run fish.

Sooner or later during the spring and summer months a proportion at least of the Salmon in the bays and estuaries of the coast make their way up the rivers for the purpose of spawning—their general colouring at this period being a brilliant silvery white, merging into a bluish black with a few dark spots on the upper part of the body and head. When first ascending from the sea, Salmon are termed "fresh-run" fish, and are then in the most perfect condition both for the rod and the table.

The marks by which a fresh-run fish may be known are, the bright, silvery hue of the belly and sides, and the comparatively loose adherence of the scales—this more particularly in the Grilse. In the case also of Salmon just fresh from the sea, a species of parasite, called "tide-lice," may be frequently found attached to the fish. These, however, are killed by a few hours' contact with fresh water.

In some rivers the ascent and spawning-time of the Salmon are much earlier than in others. This

is often the case in rivers issuing from large lakes, in which the water has previously undergone a sort of filtering process and has become warmer, owing to the greater mass and higher temperature of its source; whilst, on the other hand, streams which are liable to be swollen by the melting of snows, or cold rains, or which are otherwise bleak and exposed, are later in season, and yield their principal supply when the great lake rivers are beginning to fail.

The order in which fish ascend rivers is—allowing for the variations already pointed out—generally somewhat as follows:—

First come the strong, early runners. These are succeeded by the Grilse, and by the small "Spring Salmon" which have probably never ascended at all as Grilse, but have remained in the sea since the Smolt state—a period of from eight to ten months, as noticed in "Proved Facts," No. 10. The scales of these spring Salmon are not easily rubbed off like those of the Grilse, and their tails are not so forked. A few of them generally appear with the early-running fish. As the season advances, the larger fish and those heavy with spawn begin to work their way upwards from the mouths of the rivers and estuaries towards the higher reaches; and such fish continue ascending from the sea until the close of the autumn, or, if the river be an early one, of the summer.

Even as late as November and December, and

the January and February following, a few fish continue to run which have been usually considered as "barren"—without capability of spawning; but this notion was proved by the late Mr. Ffennell[1] to be erroneous, as upon dissection he found that the females had ova in them perfectly developed, although not larger than mustard-seed, whilst in the males a thin thread of milt was always discernible. These fish, of which many ascend the Tay in November and the three following months, remain nearly a year in the fresh waters before spawning, and although their colours gradually become darker in consequence, they are to all intents and purposes "clean fish"—a term used to express the antithesis to "foul fish"—and are exceedingly good eating.

The appearance of these so-called barren Salmon at a time when most fish are spawning, or are just recovering from the process, illustrates what I believe to be the most important fact connected with the history of the Salmon, and one which—until the publication of "Proved Facts," and my subsequent notes in the "Angler-Naturalist" in 1863—does not appear to have been at all understood, although following as a natural corollary to the propositions of Mr. Ffennell, and hinted at by Mr. Brown in his account of the Stormontfield experiments,—viz., that the principle of a *divided*

[1] See Appendix to Report of Commission of House of Lords on the Salmon Fisheries.

migration is not confined to the Parrs on going to the sea, or to the Smolts on their return from it, some as Grilse and some as spring Salmon, *but that it also extends to the old and adult fish after spawning*—one portion of these latter coming back into the rivers during the following summer, and the rest not until the spring succeeding it; in other words (and this is the gist of the whole), that at least a proportion of Salmon *spawn only on every alternate year.*

An analogous fact was observed by Dr. Davy with regard to the spawning of the common Trout. Dr. Davy was in the habit of opening the fish he caught, and by this means he discovered that, as the spawning-season approached, only about one half of the females had visible eggs, whilst in the other half there were no signs of the development of the ova. Charr, also, are frequently taken in Windermere in high condition in October and November, which is their regular spawning-season,—a fact which would seem to point to the possibility of the rule of alternate spawning-years holding good in the case of all fish here included under the genus *Salmo.*

The design of this law or instinct—which, when once apprehended, will be found to explain many of the perplexities in the history of the Salmon—is intelligible enough, viz., to ensure as large a supply of clean fish throughout as large a portion of the year as possible, and to enable each river to

support the greatest stock,—a result which could only be obtained by such a provision as the above. It is also doubtless intended to ensure an equal distribution of the fish throughout the whole length of the river. These Salmon, by ascending thus early, before their spawn is at all matured, are vigorous, and able to overcome the obstacles in their upward course to the extreme sources of the river—to which those fish which remain in the sea until heavy with spawn could never penetrate. But to return.

During the early part of the season, the Salmon in the rivers, which do not at once ascend, remain in or near the mouths, most commonly advancing with the flood, and retiring with the ebb of the tide—unless captured by any of the contrivances hereafter mentioned; but as the season progresses they get gradually further into the fresh water beyond the influence of the sea, and at about this time will be found to be becoming full of roe, and more or less out of condition and unfit for food, according to their forward state as breeding-fish. In fact, the edible qualities of the Salmon when ascending rivers depend entirely upon the state of the development of the milt or roe. Even in the salt water this loss of condition follows upon the maturing of the spawn; and when fish are precluded from entering rivers by want of a rise in the tide, or other cause, the development takes place as in the stream, and the

Salmon assume the reddish-coloured tints distinctive of spawning-fish.

With the approach of the spawning-time, the anxiety of the Salmon to ascend increases. They shoot up rapids with the velocity of arrows, and make wonderful efforts to surmount cascades and other impediments, frequently clearing a height of two or three yards at a bound. It has been calculated—though I do not vouch for the accuracy of the calculation—that, when swimming, or rather darting at full speed, the Salmon will glide through the water at the rate of about 1,500 feet per minute, or 2,160,000 feet (upwards of 400 miles) per day—a pace which, if it could be maintained, would speedily carry the fish round the world. Marvellous stories are related of Salmon-jumps, some altogether incredible, others, to say the least of it, highly improbable. No doubt the depth of the water from which they take their spring materially influences its height; but, as a general rule, the limit of the perpendicular leap certainly does not exceed 12 or 14 feet; or, if they rise higher than that, the effort is aimless, and they are dashed down again by the current before they have recovered their energy. Frequently they are killed by the exhaustive violence of their exertions, and sometimes they alight upon the rocks and are captured.

With the advance of the season the fish begin to gain the upper and shallower reaches, or spawning-grounds; and at this time all the Salmon and

Trout species resident in fresh water, both migratory and non-migratory, acquire, in lieu of their brilliant spring tints, a dusky-yellowish exterior, accompanied by a considerable increase of mucus or slime,—the fins also becoming more muscular. As the important operation approaches, these colours undergo a still further deterioration, the general hue of the body in the males assuming a browner or more golden tinge, and the cheeks being marked with orange-coloured stripes; the lower jaw elongates, and a gristly projection or horn turns upwards from the point, which is used by the Salmon as an organ of offence in its contests with other fish. In this state the males are called "Red fish," or are said to be "on the reds." The females are somewhat darker in colour, and are known by the name of "Black fish."

The Spawning-beds.

The usual time for spawning is from November until the latter end of January or the beginning of February; but there are exceptional rivers both earlier and later, as already pointed out; and it is probable that many of the so-called "barren fish," entering the fresh water in November and December, spawn in the succeeding October.

The process of spawning is as follows:—A pair of fish, male and female, select a gravelly shallow

suitable for the purpose, which is generally occupied also by other spawners, both Salmon and Trout, as well as by a considerable number of male Parrs. These latter, as stated in "Proved Facts," No. 3, are perfectly qualified to continue their species, and they perform a most important part in the reproductive process; for the attentions of the male Salmon being constantly distracted by the necessity of protecting the spawning-bed from the intrusion of other fish, the ova of the female are during these absences vivified by the milt of the Parrs.[1] The female deposits her eggs in shallow furrows in the gravel, to which they adhere by a thin coating of glutinous matter, the male at the same time shedding his milt over them. Whether these furrows are made conjointly by both spawners, or by the female fish only, and whether the snout or the tail is the organ used in the delving process, have been disputed points amongst naturalists. From the concurrent testimony, however, of those who have had the best opportunities of observation, it now appears certain that the trenches are made by the tail of the female fish only, and that the male takes

[1] According to the experiments of Mr. John Shaw (subsequently confirmed by those at Stormontfield), male Parrs attain to the breeding-state in about eighteen months from the time of hatching. The females, it would appear, never become prolific whilst in the Parr state unless they are amongst the exceptional fish, alluded to in "Proved Facts," No. 4, which remain over the third year in the rivers before migrating.

no share whatever in the more laborious portions of the parental duties.

The only extra-matrimonial function that he performs consists in exerting an unwearied vigilance to protect his seraglio from the invasions of rival males, all of whom he assiduously endeavours to expel,—living, in fact, in a perpetual state of active hostilities. The female, regardless of the frequent absences of her lord during these contests, and probably satisfied with the presence of the male Parrs, proceeds with her operations by throwing herself, at intervals of a few minutes, upon her side, and whilst in that position, by a rapid action of the tail, she digs a receptacle for her eggs, a portion of which she on each occasion deposits, and, again turning on her side, covers it up by a renewed action of the tail; thus alternately digging, depositing, and covering ova until the whole are laid,—a process usually occupying a period estimated by different authorities at from three or four to twelve days.

In the case of the male fish being captured or killed, the female retires to the nearest large pool in search of a fresh mate, with whom she returns and completes the process of depositing her eggs. This she will repeat several times if her partner be removed; and it is mentioned as a fact by Mr. Young that nine male Salmon in succession have been thus killed from the side of a single female, who then brought back with her, as companion, a

large yellow *Trout!* In consequence, we may suppose, of the arduous nature of his military duties and reddish colour at this period, the term "old soldier" is frequently used to designate the male Salmon after spawning.

Return of Salmon to the sea as "spent fish" after spawning.

After spawning, the adult fish are for some time in a very weak and exhausted state, and have not energy sufficient immediately to return to the sea. They usually drop down from the spawning-grounds, or "redds," to the first quiet deep, where they remain until their strength is somewhat recruited. They then continue falling back with the winter and spring floods, descending from pool to pool, and avoiding as much as possible weirs and rapid currents, until they reach the sea, where they quickly recover their condition, to ascend again (at least in many cases) in the autumn or succeeding spring for the same purpose as before,—always remaining, however, for a considerable period in the brackish water or tideway before making either decided change.

After the conclusion of the spawning-process, Salmon are called "spent" or unclean fish, or "Kelts;" and at this time they are quite unfit for food—indeed almost poisonous—and their capture is prohibited by law. Lately-spawned Kelts may

be recognized by their dark unhealthy colour, lanky, flaccid appearance, and by the enlargement of the vent. Their gills also are almost invariably found to be infested by a species of white worm (the *Lernæa Salmonis* of Linnæus), which adheres firmly to the inside of the gill covers, and from which they are released by contact with the salt water,—a similar release from other parasites being obtained on passing to the fresh water from the sea.

Within a period of five or six months after their return to the salt water, it has been proved that at least a proportion of Kelts find their way back to the upper reaches of the river as clean fish, having gained in weight during that time from 7 to 10 lbs.

That spawned fish improve greatly in condition before they leave the fresh water there is no room to doubt, although they are never really fit for the table until their return from their sea-trip. A fish of this kind is known as a "well-mended Kelt," a term which is common amongst fishermen.

Hatching of the Eggs and Growth of the young Fry.

Leaving now the exhausted and more or less ill-conditioned Kelts to recruit themselves in their salt-water bath, we return to the spawning-bed

where the eggs are approaching the time of hatching.

Into this bed, during the preceding three months, a dozen females have each poured the germs of, say, from seventeen to twenty thousand Salmon, which, if they all arrived at maturity, would represent in approximate figures some three million five hundred thousand pounds' weight of wholesome food, or a money-value of about £160,000. Unfortunately, however, the fry in fact added to the stock of the river are a mere fraction, and those that survive to return as Grilse a very trifling fraction of these numbers. The latter have been calculated by Mr. Brown at about one in every 1,000, and by Messrs. Ffennell and Ashworth at one in every six thousand, of the original deposit of ova.

The causes of this destruction are numerous. From the first laying of the egg until the plunge of the young Smolt into the tidal wave, and even afterwards in the broader waters of the estuary or open sea, a hundred wholesale depredators lie in wait for it. First there are the shoals of hungry fish of all kinds which prowl about the fords, pressing close behind the spawner, and ready to fight for the possession of her eggs almost before they are laid; then come the voracious larvæ of the May-fly and Stone-fly, and a host of kindred insects, which work their way in amongst the gravel and destroy, perhaps less ostentatiously, but not less certainly.

If the egg escapes these perils, and having performed its protective mission releases its charge in due course, fresh dangers await the delicate and immature nursling. Again, the trout and the wild-duck, and even the parent salmon themselves, hunt it out in its sheltering creeks and crevices; and hundreds of fry are daily sacrificed on a single spawning-bed by this means. Last of all comes man, who wantonly, either for amusement or for the sake of a single dish, fills his basket with produce which, if allowed to pass to the sea, would have returned in a few weeks worth a pocketful of gold. With these various enemies besetting every period of their existence, it ceases to be a matter of surprise that the percentage of fry attaining the Grilse state should be as trifling as it is; the only wonder is that it is not still smaller.

Many causes of destruction, however, menace the ova of the Salmon besides those enumerated: a winter flood perhaps sweeps down the river, and buries a whole brood under a foot of sand-drift; not only the duck and the grebe, but all sorts of water-fowl and amphibia perform their share of the work of depredation; and though we know but little of the habits of the Smolts when once in the salt water, it may be conjectured that their adversaries here are not less active and numerous than those of the river.

To revert to the spawning-beds.

In from 40 to 60 days after being first deposited

in the spawning-bed, the egg begins to show faint signs of animation, and the eye of the embryo fish appears, a scarcely perceptible black speck, gradually increasing in size until the time of hatching —an event which usually occurs in from 90 to 140 days, according to the temperature of the water and forwardness of the spring.

The actual bursting of the young Salmon from the egg is most interesting. The operation, which I have frequently watched, takes place thus:— The fish lies in the shell coiled round in the form of a hoop, and the greatest strain being at the back, this is, of course, the first part to be freed. At this point the shell splits across, and, after a few struggles, is completely thrown off with a jerk— leaving the umbilical sac or "yolk-bag," containing the red yolk of the egg, by which the fish is nourished during the first five or six weeks of its existence, suspended under the stomach. At this "bag-stage" of its development, the half-formed fry is exceedingly delicate, the displacement of a stone, or the slightest bruise or injury, proving instantly fatal. Its appearance is also very curious. The future monarch of the stream is represented by a mere ragged line, fringed at the edges and almost transparent, the head and eyes being prominent and altogether out of proportion to the body, which measures only about five-eighths of an inch in length, and is of a pale peach-blossom or azure tint.

In about thirty-five or forty days from the time of hatching, the yolk-bag disappears, and the fry becomes a perfect little fish of about an inch long, with the fins separated and properly developed, and the tail deeply forked at the end. The general colour now also changes to a light brown ; and the sides are indistinctly crossed by nine or ten transverse dusky bars, or Parr-marks, characteristic of all the species of the genus *Salmo* when in an immature state, and which in the true Salmon remain more or less visible even in a Smolt or Parr six inches long. If the scales are removed, the marks are much more obvious. The differences in appearance, in fact, between the fry of the Salmon, Bull-Trout, and Sea-Trout, and probably also between the fry of the other species of the same genus, are so trifling as to be scarcely perceptible unless upon very close examination, and are, moreover, liable to constant variations with local circumstances. According, however, to Sir William Jardine, the fry of the common Trout (*Salmo fario*) may always be distinguished from that of either of the three migratory species by its having the extremity of the second dorsal, or adipose, fin fringed with orange.

Up to the period of their first assuming the Parr-marks the Salmon-fry are unable to move about much, owing to the presence of the vitelline, or yolk-bag, which impedes their motions in swimming, and obliges them when at rest to lie perpe-

tually on their backs, unless artificially supported. This support they seek to obtain by placing themselves amongst gravel or in crevices between stones, exhibiting generally a great desire to escape observation—an instinct given to them no doubt for their preservation during so feeble and helpless a condition. On the disappearance, however, of the yolk-bag they come from their hiding-places, and are to be found, on careful search, in the gentler eddies and small back-waters of the streams in or near which the old Salmon had deposited their spawn during the preceding winter.

At two months old the Parr begins to acquire a more symmetrical form, and the disproportion in the size of the head ceases to be observable; at four months the characteristic Parr-marks are clearly defined, and at six months the fry has reached the length of from three to four inches, and is the small-sized Parr so constantly found in salmon-rivers. Extraordinary variations, however, are discovered in the growth-rate of fish of similar ages and even belonging to the same brood—a fact not hitherto entirely satisfactorily explained; and, within certain limits, the fish of different rivers also vary in this manner not only in size, but often in shape and colour, as much as do the qualities of the streams themselves.

Change of Parr into Smolts, and first migration to the sea.

In somewhat more than twelve months from the time of hatching—that is, between the middle of April and the early part of June—about half of the last year's Parr begin to assume the silver coating of scales preparatory to making their first trip to the sea as *Smolts*. These silvery scales, which form the distinctive mark of the Smolt as distinguished from the Parr, are never put on except when the fish is about to migrate; and without them it will not migrate at all, and cannot exist in salt water, as has been proved by experiment. The change commences by the tail, pectoral, and back-fins acquiring a dusky margin, the whole body of the fish at the same time exhibiting symptoms of a silvery exterior, with increased elegance of form.

When confined in ponds, the habits also of the transforming fish undergo a marked alteration. As Parr they show no disposition to congregate, each occupying its own place, and any intruder upon a post already tenanted being instantly and forcibly expelled; but as soon as the whole brood have completed their travelling costume—an operation usually lasting two or three weeks—they collect in a shoal, and show their desire to escape by scouring over the ponds, leaping and sporting, and generally displaying a greatly increased

amount of energy and activity. When their passage to the sea has been barred too long, Parrs in this state have been known to leap some distance on to the shore or barrier, and thus kill themselves.

It has been clearly demonstrated by the proceedings at Stormontfield that about one half the young fry migrate when about a year old—almost all the other half at their second year—and the few remaining at their third year; but the period of the descent is very generally the same in either case, and in all rivers whether early or late, beginning in March and continuing through April, May, and the early part of June—only a few fish continuing to migrate during the subsequent months. The length of the Smolt when migrating varies from $3\frac{1}{2}$ to 7 or 8 inches, according to age and other circumstances. Its full colours are, dark blue or bluish green on the upper half of the body and head, with black or carmine-coloured spots; gill-covers and lower half of body silvery; and all the fins much darker than those of the Parr. The silver scales come off upon slight pressure, and the Parr-marks are visible below.

When ready to make their trial trip, the Smolts assemble in sculls of from forty to seventy together, passing down the river at the rate of about two miles an hour, according to some authors, in family groups. Thus resting in the slack waters, and at intervals braving the rapids and strong

currents, they drop gradually down the river, unless on the occurrence of a heavy flood, which sweeps them at once into the sea. On meeting with the tide they remain for two or three days in the brackish water to fit them for their change of habits, and then go off to the sea altogether.

What becomes of the young fish after reaching the ocean is at present a matter of conjecture. What we do know positively is, that in from six to eight weeks a number return to the same river with an increase in weight of 2 to 5 lbs., and that many of the fry marked when migrating as Smolts in May and June, were sold in the London markets as Grilse in July, August, and September. It is a fair point for conjecture, and would be an interesting subject for future experiment, whether the Grilse returning the same season may not consist principally of the two-year-old Smolts, and so on; or whether, should this prove not to be the case, these older Smolts may not represent the larger-sized Grilse, and the younger fish the smaller ones.

Of the habits and food of the Salmon in its various stages whilst in the sea we know little. In his evidence before the Select Committee of the House of Lords in 1860, Professor Quekett stated it as his opinion that Salmon travelled some distance along the coasts, and probably into deep water, in search of the ova of the Echinus or Sea Urchin—a species commonly inhabiting a depth

of not less than from 6 to 20 fathoms. Professor Huxley disagreed with this view as regards the nature of the food, and believed that it consisted chiefly of a numerous class of small creatures (*Entomostracous Crustacea*) found in semi-solid masses upon the surface frequently of deep water—in fact, that the Salmon swims in a species of animal-soup, in which it has merely to open its mouth and swallow what enters it. Dr. Knox was of opinion that the food consisted of the ova of various kinds of *Echinodermata* (Star-fish, Sea Urchins, Encrinites, &c.) and some of the *Crustacea* (Crab and Lobster family). Faber, in his "Natural History of the Fish of Ireland," says, "The common Salmon feeds on small fishes and various small marine animals." Dr. Fleming and several other naturalists have observed upon their partiality for the Sand-eel or Sand-launce—a fact which is confirmed by Sir John Richardson, who states that he has himself taken this fish from their stomach. Sir William Jardine also says that in the north of Sutherland a mode of Salmon-fishing is successfully practised in the firths with Sand-eels attached to a buoy or bladder, and allowed to float with the tide up the narrow estuaries. The worm, the Minnow, and Parr-tail are all, under certain circumstances, known to be deadly baits for the Salmon; and in an essay published in the "Transactions of the Highland Society," vol. ii. p. 392, Mr. Alex. Morrison says, "I have taken Salmon

within flood-mark, some of which had two, and others three full-sized herrings in their stomachs."

Judging from the perfect arrangement of its teeth and the known habits of its allied species, there can be no doubt that the Salmon is a voracious feeder,—although the very small amount of food usually found in the stomach has been hitherto a source of difficulty in ascertaining its exact nature. The singularity of this latter circumstance was formerly the subject of an interesting correspondence in the "Field," in which it was suggested, amongst other less possible explanations, that the gastric juice of the fish was so powerful as to dissolve almost instantaneously whatever was subjected to its action,—another hypothesis (and the more probable) being that the fish ejects its food on finding itself hooked or netted.

Be this as it may, one point seems certain, viz., that such a marvellously rapid growth as that shown to take place in the Salmon can only be produced by a corresponding supply of nutritious food; and as regards the travelling or otherwise of the fish in the sea, the thousands of Salmon constantly taken in nets along all parts of our coasts are a clear proof that they do rove, at least to considerable distances, from their native rivers and estuaries.

During their sojourn in the sea after their first spawning the growth of the Grilse is exceedingly rapid, a considerable proportion at least of such

fish returning to the river in the summer and autumn with an increase in weight of 5 to 9 lbs. In twelve Grilse of 4 lbs. each which were carefully marked by Mr. Young when descending to the salt water, this was found to be the average increase on their return during the same season.

Whether the growth-rate is as rapid in the after-stages of their existence we have no accurate means at present of judging; but reasoning from analogy it would appear probable that it decreases somewhat with the advancing age of the fish, and in very old specimens is perhaps comparatively trifling. Of such Salmon, the largest recorded to have been captured in British waters was a female fish of the weight of 83 lbs., which was exposed for sale in the shop of a London tradesman in the year 1821. Another of 74 lbs. is alluded to by Pennant; and Mr. T. Grove, the well-known fishmonger, of Parliament Street, informs me that he has had Salmon in his possession weighing upwards of 60 lbs.

Some very large Salmon have been occasionally caught with the rod. One is noticed by Mr. Lascelles, as taken in Scotland, which weighed $54\frac{1}{2}$ lbs. The late Sir Hyde Parker captured one in Sweden weighing 60 lbs. A Salmon was caught by Sir H. Davy above Yairbridge in the Tweed, of the weight of 42 lbs.; and a former Earl of Home took another from the same waters of the perhaps unequalled weight of 70 lbs. within a few ounces.

Much controversy and many experiments have been devoted to the question, "Will Salmon live and thrive entirely in fresh water—that is, in lakes or ponds which have no communication with the sea?" The answer appears to be in the negative, so far as all practical purposes are concerned. It has been proved that the fish will so far increase under these conditions as to attain a maximum weight of a few pounds; but the flesh of such fish is comparatively white and insipid, and as an article of food altogether different from that of the sea-bred Salmon.

The characteristics common to all the Salmon and Trout family (*Salmonidæ*), of which we have several genera in Great Britain, are,—bodies scaly; two back-fins, all the rays of the first fin soft; the second fin adipose or fatty, without rays; numerous gill-rays; air-bladder large and simple. Of this family, the first genus (*Salmo*) embraces all fish following the common Salmon and Trout as their types, in which we find the head smooth; teeth on the vomer, the tongue, both bones of the palate, and on all the jaw-bones above and below; gill-rays varying in number, generally from ten to twelve, but sometimes unequal upon opposite sides; whilst a great part of the margin of the upper jaw is formed of the maxillary bones.

In addition to these, and the generic distinctions already given, the Principal Characteristics of the True Salmon are:—

Length of head compared to whole length of fish as 1 to 5. Body elongated; dorsal and abdominal line about equally convex; lateral line near middle of body, dividing it about equally. Fleshy portion of tail slender. Scales moderate-sized, oval, and thin, easily removed when young, adherent when old. Teeth stout, pointed, and curved, one line on each side of upper jaw, one line on each bone of palate, one line on

omer or central bone in roof of mouth when quite young oses a large portion on first visit to salt water, and gradually ll, or all but one or two on most forward point of bone), one ine on each side of lower jaw, one line on each side of tongue occasionally two lines on each side of tongue).

Shape and position of fins in Salmon, Bull-Trout, and Sea-Trout.

SALMON.	BULL-TROUT.	SEA-TROUT.
Tail-fin deeply forked when young, less so at 3rd year; at 5th year nearly or quite square.	Becomes square at an earlier period than in Salmon, and afterwards gradually convex.	Less forked than in Salmon of same age; becomes ultimately square. Tail shorter and smaller than in Salmon.
Dorsal fin:—Hinder origin about half-way between point of nose and end of tail-fin. Third ray longest.	Commences about half-way between point of nose and origin of upper tail-fin rays. Base of dorsal longer than longest ray.	Hinder origin exactly half-way between point of nose and end of tail-fin. Second ray longest, same length as base of fin.
Adipose fin:—Hinder origin half-way between origin of last back-fin ray and end of tail-fin.	Nearer to end of tail-fin than to origin of last dorsal fin ray.	Half-way between origin of last ray of back-fin and end of tail-fin.

To the above it may be added, that in the Salmon the pectoral fin equals two-thirds of the length of the head, whilst in the Bull-Trout it equals little more than half,—the anal fin also in the former commences about halfway between the origin of the ventral fins and the origin of the lower tail-fin rays, and in the latter nearer to the tail.

The teeth of the Bull-Trout are larger and stronger than in the other two species, and those of the Sea-Trout are the most numerous.

Fin-rays: D. 13: P. 12: V. 9: A. 9: C. 19. Vertebræ, 60.

THE BULL-TROUT.[1]

THE Bull-trout, also known as the Grey-trout, Sewin, and Round-tail, is a somewhat local fish, sparsely scattered throughout several parts of the United Kingdom, and probably more generally familiar to the ichthyologist than to the fisherman. I believe the lithograph illustrating this chapter to be the only really accurate drawing of the fish ever published in England, most of the representations with which I am acquainted being strikingly unlike their prototype in almost every particular. It was taken from a male fish of 8½ lbs. weight, in beautiful condition, brought from the Tweed,—a river in which the bull-trout is more abundant and reaches to greater perfection than in any other of these islands. The total length of this specimen was 2 ft. 4½ in., and the girth of the shoulder, just behind the head 14½ in.

[1] *Salmo Eriox*. *Salmo*, a Salmon or trout, Lat.; *eriox* specific name.

(*Salmo eriox*)

Although in an edible point of view inferior to both its congeners, the Salmon and Sea-Trout, looked at with a sportsman's eye the Bull-Trout is a noble fellow. There is a breadth of build and general "strengthiness" about him which makes us feel that he would be a "foeman worthy of our steel"—if we could but induce him to try conclusions with us; if he would but once favourably regard our feathered dainty with that cautious, cunning eye of his. But to get a big clean-run Bull-Trout to take the fly is a piece of luck that does not very often fall to the fly-fisher's lot, even in the rivers where he is most plentiful. Lord Home, himself a Tweed-side man, and who boasted that he had killed more Salmon with the rod than any other man ever did, says, that "putting them all together I am certain that I have not killed twenty clean Bull-Trout. Of Bull-Trout kelts thousands may be killed." The season when they run up the Tweed is also against the fisherman, as only the small fish of a few pounds weight are to be found in the river in the spring (April and May), whilst the largest shoals, and those consisting of by far the biggest fish, weighing from 6 to 20 lbs., do not leave the sea until towards the latter end of November. These November fish are in the best condition.

"The great shoal of these Bull-Trout," says Lord Home, "not taking the river till after the commencement of close-time are in a great measure lost both to the proprietor and the public."

Yarrell, however, speaking of the Bull-Trout generally, appears to differ from this view, as it is evident that if the fish do not run up the rivers till November, they spawn later than the salmon; whereas Yarrell on the contrary asserts that "they ascend rivers for the purpose of spawning in the same manner as the Salmon, but earlier in the season; and the fry are believed to go down to the sea sooner than the fry of the Salmon." This discrepancy is probably to be explained by the difference of habits in fish of different waters.

Some of the most obvious characteristic divergencies between the Bull-Trout, the true Salmon and the Sea-Trout have already been given in the preceding chapter.

A glance at the illustration will at once show the remarkable difference in form between the adult Bull-Trout, and either the full-grown Salmon, or Sea-Trout; the Bull-Trout being obviously shorter, thicker, and generally more muscular—in fact, as its name would appear to express more bull-like in appearance. The Bull-Trout, moreover, is thickly spotted with brown over the back and sides, both above and below the lateral line, and even to the tip of the dorsal fin, which in the salmon is seldom or ever marked with more than a few "sploches," and those close to the base of the fin. The dorsal fin of the Sea-Trout is generally spotted like that of the Bull-Trout, though not quite so

thickly. Speaking generally, the fins of these latter fish are more muscular and larger in proportion to the rest of its body than those in either of the other two allied species.

Amongst the localities in which the Bull-Trout is known to exist, may be mentioned some of the streams of Devonshire and Cornwall, the Severn, several of the rivers of South Wales—I have caught hundreds in the Usk above Brecon—and, according to Dr. Heysham, some of the Cumberland waters debouching into the Solway Frith. In Ireland it occurs very generally on either side of the northern portion of the island; and Killala Bay, Donaghadee, Florence Court, Beleek, Crawfordsburn, Nannywater, Ballyhalbert, and Dundrum are all referred to by Thompson as places whence he had obtained specimens.

Sir William Jardine mentions that the Bull-Trout has been found in the Annan, Dumfriesshire; and by Mr. Low it is stated to be an inhabitant of the Loch of Stenness, Orkney. The Liddell, which runs through Roxburghshire, appears to have been once renowned for this fish. Sir Walter Scott, in his notes to the "Lay of the Last Minstrel," says there is an old rhyme which thus celebrates the places in Liddesdale remarkable for game:—

> "Billhope braes for bucks and raes,
> And Carit haugh for swine,
> And Tarras for the good Bull-Trout,
> If he be ta'en in time."

"The bucks and roes as well as the old swine are now extinct, but the good Bull-Trout is still famous."

All laws relating to Salmon apply equally to the Bull-Trout and its young, under whatever local names they may be known.

Principal Characteristics of the Bull-Trout (in addition to those already given in preceding chapter).—Length of head compared to body only, as 1 to 4; general form of body similar to that of the Salmon, but nape of neck and shoulders thicker, and fleshy portion of tail and base of each of the fins more muscular. Teeth of female smaller than those of male. Elongation of lower jaw confined to the males only; not so conspicuous as in the Salmon. Scales rather smaller and more numerous than those of a Salmon of equal size. Colour: when in good condition like that of the Salmon-Trout: at spawning-time, (in the *males*) head olive-brown, body reddish- or orange-brown; (in the *females*) blackish grey; in both fish the back-fins reddish brown, spotted with darker brown, tail-fins dark brown, the other fins dusky brown. Vertebræ commonly 59, occasionally 60.

Fin-rays: D. 11: P. 14: V. 9: A. 11: C. 19.

THE SEA-TROUT OR SALMON-TROUT.[1]

THE Sea-Trout, the last of our Silver or Migratory species, has been identified with the *Salar* of the Moselle, so named by Ausonius in the fourth century—

"Purpureisque *Salar* stellatus tergore guttis."

In habits also it closely resembles the *Salar*, or true Salmon, of modern ichthyologists, and is included in all statutory restrictions affecting this fish or the Bull-Trout.

It is the only one of the Migratory species which is likely under any circumstances to be confounded with the Yellow Division of Trout—or rather with the *Salmo fario;* but the difference in colour between the two fish—the one being silver and the other golden—is usually too obvious to admit of doubt. It occasionally happens, however, that the Sea-Trout, especially when confined for a long time

[1] *Salmo trutta*. *Trutta*, trout, Lat.

in a loch, acquires a colour not altogether unlike that of the Yellow Trout; and when this is the case a reference to the teeth on the vomer, or central bone on the roof of the mouth, will often settle the point.

These teeth in the common Trout (and also in the Great Lake Trout) run in two distinct rows, whilst in the Sea-Trout they run only in a single row. It is to be observed, however, that the arrangements of the teeth require to be rather closely examined, as in the case of the Sea-Trout the points bend alternately to either side, so as to present rather the appearance of a thinly planted double row; whilst in the common Trout the two lines of teeth are placed so that a space in one row has a tooth opposite it in the other, making the difference appear at first sight to be little more than one of comparative closeness in the setting of the teeth.

In regard to the Sea-Trout of the Tweed, Lord Home has the following note:—"Of this excellent species I can only repeat that in the Tweed they have almost entirely disappeared. They afford good sport to the angler; but I never saw one above 7 lbs. weight. Of the Phinock of the Spey, Hirling of the Nith and Annan, the Whitling or Whiting of the Esk, all one and the same fish, I can say nothing. There is a little fish, however, which makes its appearance about November and December, but in very small numbers, few only

THE SEA TROUT *(Salmo trutta)*

Vincent Brooks, Day & Son, Lith.

To face page 38

being caught, and those of course with the hook. They are called here Silver-whites, and also Black-tails, from a dusky-blue spot in the centre of the tail-fin. They are a beautiful little fish, resembling much small Sea-Trout; and if not young Sea-Trout, I know not what they are."

The Don, the Spey, the Tay, the Annan, and the Nith, all produce the Sea-Trout in great abundance, as also some of the rivers of Devonshire, where it is called a Truff. It is found in the Severn, and in the Cumberland and Cornwall streams. On the banks of the rivers falling into the Solway Frith, it is termed in its grilse stage a Hirling; and in Wales and Ireland, where it is very numerous, it commonly goes by the name of White Trout.

White-Trout fishing on some of the Scotch and Irish lakes is grand sport, and, like other lake-fishing, has an advantage in that, a boat being usually employed, ladies who are not strong enough to wield a Salmon-rod or face the difficulties of a scramble down a rocky river-bank, are able to take part in it. In speaking of ladies as White-Trout fishers, I am reminded of a disgraceful practical joke of which I was, I fear, the chief instigator and abettor, and of which a very charming young lady, and a capital angler to boot, was one of the victims. The scene was Loch Maree. When staying with my friend Mr. Edwin Darval at the Poolewe Inn, on fishing designs intent, we

made acquaintance with a gentleman well known amongst the Cotton Lords of Lancashire, who, with his daughter, spent most of their days, like ourselves, in fly-fishing for White Trout on the loch. One evening at dinner we made a match. We wagered sundry bottles of champagne that as the result of the next day's foray amongst the Trout our "basket" would outweigh theirs. Accordingly, next morning both parties started betimes for the lake; and as the boats kept pretty well within hail of each other, we could guess by the use of our eyes and ears that we were well on the winning side, when, just as we were returning, Miss G—— hooked, and, after some pretty play with her light Trout-rod, landed, a Grilse of at least five or six pounds weight!

The Trout in the part of the loch we had been fishing ran comparatively small, and despite our superiority in numbers it was evident that this "happenin' baste," as our boatman called it, would turn the day against us.

What was to be done? For two experienced fly-fishers, who plumed themselves not a little on their "talent," to be beaten in a walk by a 'chit of a schoolgirl' and an old gentleman of seventy was ignominy not to be endured. . . . Necessity is the mother of invention. As we were landing a bright idea suddenly struck me—I recollected the story of the "Jumping Frog." . . . Making some excuse to let our antagonists get ahead a

little, we rapidly crammed down the throats of our Trout as many small round pebbles as they could bear without bursting. . . . Well, yes, it *was* very shocking—I'm sure, dear reader, you wouldn't have done such a thing! . . . We "won the race," however—rather a close thing, by-the-bye, after all—and luckily escaped detection on "weighing in," notwithstanding the suspicious abdominal appearances of our fish. "Singular," was the only remark the old gentleman made, "but your Trout seem to be all in roe!"

Of course we confessed our shameful imposture—after the champagne had been drunk.

À propos of lady-anglers, I would point out here that fishing—especially such fishing as I have been describing—is of all field sports that most suited to their strength and physique. On this subject I have observed in the "Badminton Library of Sport," "A woman's figure makes the handling of the gunstock always rather awkward, and the recoil is sometimes apt—unless very light charges are used—to be dangerous. But to fishing there is no drawback, unless, indeed, it be the petticoats with which some thick-ankled leader of fashion in bygone times has managed to cramp and disfigure one of the prettiest parts of the human form. No skirts will vex the 'tameless ankles' of our women of the future. Already there is a marked and healthy improvement visible in the length of the dress, and women need no longer draggle about

behind them a ridiculous and often muddy train, which if it does not do duty for a road-sweeper cannot certainly be shown to subserve to any other useful purpose.

"The influence of dress has been recognized by many philosophers as exercising a powerful effect in moulding the national character; and I am quite satisfied that if English men and women, and those living in town as well as in the country, were to adopt a dress allowing greater freedom and play to the limbs and muscles, and (so far as men are concerned) would discard, once and for all, chimney-pot hats, frock coats, leg-bags—I use the term literally, not in a slangy sense—and the other paraphernalia of the hand-box, there would be a marked advance in the manliness and 'robustness' of the race.

"Women who shoot or fish should never hesitate to wear a dress suitable for the purpose; long skirts are not only constantly in the way, but often prove a source of real danger to the wearer. The same remark holds still more true in regard to long riding-habits; and if the readers of these lines had seen as many accidents, and hair-breadth escapes from accidents, in the hunting field, as I have, owing to long skirts, they would join in the outcry which ought, in the name of common sense, to be raised against them. However, I am glad to see that there is some improvement of late years in this respect also.

"In arranging a lady's fishing-dress, next to the short skirts thick boots more or less waterproof are the most important item, having regard both to protection and comfort; but this is precisely the point on which the male adviser finds the greatest difficulty in procuring a favourable hearing for his views. Simply on the score of 'prettiness' it cannot be said that a stout double-soled shooting or fishing-boot is as 'killing' as a Queen Anne slipper, Louis Quatorze shoe, or a pair of dainty *bottines*, expressly designed to set off and emphasize the delicate arch of the instep, whilst displaying the foot and ankle in a position which, if not quite natural, is at least exceedingly picturesque—

> 'The flower she touch'd on, dipp'd and rose,
> And turn'd to look again.' . . .

"But, my dear lady readers—if I should be so favoured as to have any—do not let it be forgotten that there is 'a beauty of fitness,' and that where really rough work has to be done, 'ease before elegance,' and, it might be added, 'health before both,' is a golden maxim.

"The following hints for dress, which have been kindly given me by a lady who has had large practical experience with both rod and gun, may possibly be found of service :—

"'Short skirt of linsey-wolsey made as simple as possible—in fact, a kind of 'housemaid's dress.' Norfolk jacket made of *all wool* material. A comfortable toque (the close-fitting

toque does not catch the wind). It is best to have the costume of one colour, say a nice heather mixture or whitish grey. I advise 'linsey' for the skirt, as it is everlasting in wear, and the 'all wool' for the Norfolk jacket, being warmer and more healthy.

"'Now for the most important item—boots. They should fit perfectly, and be made of porpoise-hide, with honest broad soles and plenty of room for the toes, and flat heels—in their proper place, *not* under the arch of the instep. The boots should lace in the same way that men's shooting-boots do, and be made to come well up the leg (so that gaiters can be dispensed with). Length of skirt an inch or so above the ankle.

"'This dress is suitable for either fishing or shooting. If worn for the latter over a 'clayey' country, a few inches of light waterproof on the bottom of the skirt are advisable. Some ladies wear gaiters, but I think if the boots are made high enough they are not necessary. 'All wool' under-garments should be worn, from stockings upwards.'

[For this purpose I most strongly recommend, from personal experience, the 'all wool clothing,' manufactured and sold by the "Jaëger Sanitary Clothing Company," Princes Street, Cavendish Square. These garments, from stockings to overcoats, all made under Dr. Jaëger's instructions, are beautifully light, warm and healthy.]

"The comfort to the fisherwoman, as well as to the fisherman—and, indeed, to all sportsmen—of boots which are both thoroughly easy and at the same time completely waterproof, is so obvious that I make no apology for offering a few hints on the subject, the more so that during experiments extending over some decades I have myself suffered 'many things at the hands of many boot-

makers.' Any bungler in the trade can, of course, make at least a passably waterproof boot if he allows himself unlimited latitude in the matter of weight and clumsiness, or 'stiffness.' The art is to make a boot waterproof, and at the same time light, and as soft to the foot as a kid glove."

I have, at last, however, succeeded in finding some bootmakers who can make shooting-boots which fulfil these conditions. Messrs. Dowie and Marshall, 455, Strand, have, working on the lines I suggested, lately made me several pairs of shooting-boots weighing only about 2 lbs. the pair, instead of 3 lbs. or 4 lbs.,—the ordinary weight—and as comfortable and impervious to water as the most exacting can desire.

For "waterproofing" all cloth and woollen materials—I do not say making them actually waterproof, but sufficiently so to keep the under-garments practically dry—I can recommend the following receipt, given me by R. Atkinson, Esq., of Temple Sowerby :—

> Dissolve sugar of lead and alum in *rain* water, one ounce of each to a quart of water. When settled down, draw off the clear (this is most easily done with a syphon), *saturate* the *woollen* article in it (I generally leave it in twenty-four hours), and dry in the open air. From my own experience I have found a coat thus treated to be quite waterproof.

From 1 to 5 lbs. is the usual weight of the Sea-Trout, but much larger specimens have been recorded. In 1840, a male Sea-Trout was taken at

Sandstill fishery in the mouth of the Tweed, which was 37 inches in length, 22 in girth, and which weighed 24½ lbs.

Such a size is, however, of course entirely exceptional, and a fish of a more normal weight gives a better idea of the ordinary run of Sea-Trout as met with constantly in our lakes and rivers. The specimen selected for the illustration was a female Spey fish, weighing 11½ lbs.

Principal Characteristics of the Sea-Trout.—Length of head compared to body only, as 1 to 4; depth of body compared to whole length of fish also as 1 to 4. Teeth small and numerous, in five rows on upper surface of mouth, those on the vomer, or centre bone in roof of mouth, generally extending some distance along it, the points turning outwards alternately to either side; one row on each side of under jaw, and 3 or 4 strong, sharp, and curved teeth on each side of tongue. Shape of tail-fin, and relative position of fins, see p. 31. Lateral line very nearly straight. Scales adhering closely, in form rather a longer oval than those of the Salmon. Colour when in season: upper part of head and body bluish black, lighter on sides, which are marked (principally above the lateral line) with numerous spots somewhat resembling in form the letter X. Lower parts of sides and belly, cheeks, and gill-covers silvery white; back-fins and tail nearly same colour as back; pectoral fins small, and bluish white; anal fin and ventral fins white. Vertebræ 58.

Fin-rays: D. 12 : P. 13 : V. 9 : A. 10 : C. 19.

THE COMMON TROUT.[1]

WITH the Common Trout—the Yellow "burn" and Brown Trout of the angler—we commence the Golden, non-migratory species of the genus Salmo.

This group is at once distinguished from the last-named by the difference in colour, a mark which, with the one occasional exception in the case of the Sea-Trout, already referred to, will generally prevent the possibility of any confusion. It is also easily distinguished from the Charrs, or Third Division, by the red and orange colours of the latter, and by the additional characteristic of having two complete rows of teeth on the vomer, whilst in the Charrs the vomer has only a few teeth, and those on the most forward part.

Of the Yellow Trout there are probably only two really distinct species in this country—though

[1] *Salmo fario*. *Salmo*, a Salmon or Trout; *fario*, *the* Trout, Lat.

the varieties are numerous, and in some instances present such considerable differences, as to have led to their being classified as separate species—as, for example, the Loch Leven and Gillaroo varieties.

The universally admitted species are—

The Common, or Yellow Trout (*Salmo fario*), and
The Great Lake Trout (*Salmo ferox*).

In regard to each of these the specific characteristics are given in detail at the end of the several articles; but a few general observations here will possibly enable the reader to distinguish them without the necessity of resorting to a minute comparison.

1. As regards localities.—The Common Yellow Trout breeds indifferently in brooks, rivers, and lakes, whilst the Great Lake Trout is never found except in or close to lakes, and these almost always large and deep.
2. The flesh of the Great Lake Trout is generally a sort of orangey-yellow, and that of the common Trout pink or white, according to the nature of the water and the condition of the fish, the spots also on the former are usually surrounded by a paler ring, sometimes of a reddish tint.

THE COMMON TROUT *(Salmo fario)*

To face page 48.

3. *Length of head.*—The disproportionate size of the head in the Great Lake Trout is very remarkable, it being usually little less than one-fourth of the total length of the fish, tail-fin included, whilst in the Yellow Trout it is commonly not much more than one-fifth.
4. *Tail-fin.*—The tail-fin in the Great Lake Trout (as shown in the illustration), is nearly square at the end, and is considerably wider than the widest part of the body, whilst in the Common Yellow Trout it is very obviously narrower than the same measurement.

By bearing these characteristics in mind, the student of ichthyology should be readily able to distinguish with tolerable certainty between the two species. I say with "tolerable certainty," because an intimate knowledge of the distinguishing characteristics of the various species of *Salmonidæ* is very difficult to acquire, and is, indeed, rarely attained except by the scientific ichthyologist, or by the fisherman (angler) who has passed half a life-time on the river bank, and who ekes out a little "science" with a great deal of "practice."

Except in some of the more permanent characteristics already alluded to, the varieties to be found amongst Trout are simply endless. Its colouring and even its shape are susceptible of infinite difference, and vary as much as the qualities of waters (whether in sources or feeders),

geological strata of the beds, and nature and quantity of food supplied by the brooks, streams, rivers, ponds, lynns, and lakes in which it is bred. The diversity of colouring is, in fact, a defence furnished by nature for the preservation of the fish, which would otherwise be so plainly visible upon the slightest change of water or soil as to fall an easy prey to its enemies, whether biped or quadruped; and experiments have shown that the change is a question of minutes rather than of days or weeks. Upon its transfer from a light- to a dark-coloured vessel, or *vice versâ*, the hue undergoes an instant alteration, and in a very short time assimilates itself more or less perfectly to that of its new domicile. Thus, for instance, the Trout of Lynn Ogwin, almost the whole bottom of which is formed of grass, have, when first caught, a brilliant emerald gloss over their golden and yellow tints; and although the waters are of the utmost clearness and the lake swarming with fish, I was never able in any one instance to distinguish these from their surrounding green. Again, in the Spean Water, Inverness, there are several small tarns in which I have frequently taken fish of almost the colour of ink; yet these tarns actually join the Spean, where many of the Trout are of a fine rich yellow,—the cause of the difference being that the river has a bed of gravel, whilst the tarns are floored with a deep deposit of bog mud. I have even known a similar difference to exist between

Trout frequenting opposite sides of the same river or loch.

Amongst special breeds of Trout which have in process of time, owing to local circumstances of food, &c., acquired certain well-marked, and, so to speak, permanent, peculiarities, may be mentioned the Trout of Loch Leven, in Scotland; the Gillaroo Trout of Ireland; and the Botling found in some of the Cumberland lakes. The Botling is described by Dr. Davy, in his "Angler in the Lake District," as ascending the lake streams in the autumn, and as being a fierce, powerful fish, frequently attacking the other *Salmonidæ* whilst spawning. In form, it is short and deep, with the lower jaw much hooked, or curved upwards; and when full-grown, its girth considerably exceeds its length. In the arrangement of its teeth and spots it resembles closely the ordinary type of Trout.

The largest of the Irish lakes, Lough Neagh, as well as L. Bofin, L. Corrib, L. Mask, and others, produce a Trout which has been by some naturalists too hastily considered as a distinct species—the Gillaroo. The inner coats of the stomach in this fish are considerably thickened, so as to afford increased muscular power, and the teeth are remarkably small; but beyond these, and the mere divergences in external form, so little difference appears to exist between it and the common English Trout as to lead to the conclusion that the Gillaroo is only a variety of that species.

The Loch Leven Trout derives its name from the barren lake, and now dismantled castle celebrated as the prison of the unfortunate Mary Queen of Scots; but it has also been recognized by Dr. Parnell in several other Scotch lochs.

The two most noticeable points in which the Loch Leven variety differs from the Common Trout are (first) in the colour of the flesh, which is—or used to be—almost of a deep red; and (secondly) in the absence of any red spots, which are almost constantly present in all other varieties of the *Salmo fario*. The red colour of the flesh is supposed, with good reason, to be due to the small species of shell-fish or water-snail, which especially abounds in Loch Leven, and forms, probably, the staple article of the Trout dietary. During the last thirty years the Loch Leven Trout are said to have considerably fallen off in colour and condition, owing to the partial draining of the loch having destroyed some of their best feeding-ground. They spawn in January, February, and March.

The Thames and the Avon are amongst the waters producing the largest breed—and I might say the largest individual specimens—of *Salmo fario*, or Common Trout, with which I am acquainted. Thames Trout of 5 lbs. to 10 lbs. weight are common, and captures are on record of fish up to at least 16 lbs. or 17 lbs. The same weights could easily be equalled- and indeed surpassed—from the chronicles of the Avon.

At Herdcott House, near Salisbury, there is preserved the skin of a Trout that turned the scale at 25 lbs., and was in length 4 feet $2\frac{1}{2}$ inches; in girth it measured 2 feet 1 inch. Another fish is recorded to have been taken in a small tributary of the Trent at Drayton Manor exceeding in weight 21 lbs.; but there appears to be some doubt whether it was a *bonâ fide* Yellow Trout or a *Salmo trutta.*

The usual spawning-time of Trout is in the latter end of October or November, and thence up to the beginning of February (the operation, however, in each particular fish continuing only about eight days); and at this period the under jaw in the old males exhibits in a modified degree the elongation and upward curving characteristic of the male Salmon at the same time.

From the experiments of Dr. Davy, elsewhere commented upon, it appears probable that at least a proportion of Trout, like some Salmon, spawn only in alternate years. The situation chosen for, and the mode of conducting the spawning-process are also very similar to those noticed in the Salmon,—the eye, however, of the young fish becoming visible in about three weeks, and the egg being usually hatched in from forty to fifty days. The number of eggs, in proportion to the weight of the fish, is about the same as in the case of the Salmon. The yolk-bag is absorbed in from three to five weeks; and in six weeks or two months the young fry are about an inch long and able to shift

for themselves. From this time their growth is rapid or slow according to the nature and quality of their food and other local circumstances.

In order to ascertain the relative nourishment of the different descriptions of food, some interesting experiments were made not many years ago. Trout were placed in three separate tanks, one of which was supplied daily with worms, another with live minnows, and the third with flies. The result was, that the fish fed with worms grew slowly and had a lean appearance,—those dieted on minnows became much larger,—whilst such as were fattened upon flies only, attained in a short space of time extraordinary dimensions,—weighing twice as much as both the others put together—the quantity of food eaten by them being actually less.[1]

On another occasion Trout were kept for many years in a store stream, and tested with various kinds of diet, when it was ascertained that in some instances the increase in weight was as much as 9 lbs. in four years (or from 1 to 10 lbs.)

Recent piscicultural experiments have demonstrated the great value of the Fresh-water Shrimp ('Gammari') as an article of fish diet, and for feeding young fry on, and I once had an exceptionally good opportunity of verifying the growth-rate of Trout when fed upon this insect. I quote from my volumes on Fishing in Messrs. Longman and Co.'s "Badminton Library of Sport:"—

[1] Stoddart, "Art of Angling in Scotland."

"At Encombe, in Dorsetshire, the seat of the Earl of Eldon, there is an artificial pond of two or three acres in extent facing the house. The pond is paved with marble at the bottom and sides, and is supplied with water from a small fountain fed from a spring in the neighbouring valley, carried by an artificial tunnel under some high hills. The pond is, for all practical purposes, stagnant; the fountain's supply not being more than equivalent to the summer evaporation. From 1862 to 1864 this pond was drained off and left absolutely dry, in order to kill the weeds and clean the bottom. In 1864 the water was turned in again, and in August of that year a number of artificially reared Trout of the same season's hatching, about three-quarters of an inch long, were put into the pond. In August, 1866, the pond was again dried for cleansing purposes, when it was found that the Trout had grown in the space of two years to an amazing extent—four or five pounds being the smallest size, and a weight of six pounds ten ounces having been attained in several cases.

"When visiting at Encombe in September of the following year, I examined the pond at Lord Eldon's request, with a view to ascertaining to what cause, in the absence of any artificial feeding, the extraordinary growth rate was to be attributed. With the aid of a bucket and a rope, the explanation was not hard to find: *the whole pond was simply swarming with water shrimps*, and on ques-

tioning the keeper he assured me that when the water in the pond was let off there were literally cart-loads of these insects. My informant as to the facts and dates was Lord Eldon, who also examined the keeper in my presence as to the circumstances, and whose account was again confirmed in every respect by the corroborative testimony of Mr. Dickson, one of Lord Eldon's stewards, who was present and saw the fish weighed when caught.

"The only outlet to the pond was a small drain at one end, up which nothing could practically pass, even if there were any Trout streams at hand with which it could be supposed to communicate.

"It may be mentioned that the weight of the Trout at the end of the first year was from a quarter of a pound to half a pound."

From this account and the experiments on the different modes of fattening Trout above referred to, it is evident that fish and grubs bear no comparison with insect-food in point of nourishment, doubtless in consequence of the amount of phosphate of lime contained in the latter. Of the insects specially contributing to the food of fish, probably the most nutritious of all are the May-flies, upon which, when arrived at maturity, the adult Trout wreak a signal vengeance for the destruction effected by the larvæ of the one amongst the eggs of the other.

Principal Characteristics of the Common Trout (Salmo fario). (Taken from a Hampshire fish, 12 inches in length.)—Length

of head compared to length of head and body, without tail-fin, as 1 to 4; depth of body rather greater than length of head. Profile of back and belly about equally convex. Head blunt; lower jaw longest when the mouth is open, but shutting within the upper jaw on its being closed. Back-fin commencing between point of nose and commencement of upper rays of tail-fin; third ray of back-fin longest, and longer than base of fin. Small back-fin commencing halfway between origin of large back-fin and upper extremity of tail-fin; pectoral fin two-thirds of length of head; ventral fins under middle of first back-fin, and half-way between origin of pectoral fin and end of base of anal fin; anal fin beginning halfway between origin of ventral fin and commencement of lower rays of tail-fin. Tail slightly forked, very gradually becoming square, or slightly convex in very old fish. Pyloric cæca[1] seldom exceeding 46 in number. Teeth numerous, strong, and curving inwards, in six rows on upper surface of mouth and jaw, and four on lower. Teeth larger in males than in females. Number of scales above and below lateral line about 25. Vertebræ 56.

The following were the full colours of a Dartmoor Trout taken by the author in May, 1885 :—

The under line of belly (not seen when fish is looked at sideways), white; sides, for one third of the way up, golden yellow; two lines of red spots, one above and one below the lateral line: dark brown spots all over back, also above the lateral line, and a few below it just behind the gills; a few black or dark brown spots on the gill cover (*operculum*). Head, gill-covers, and irides green bronzy-gold; back and top of head, bronzy-green; golden under the throat. Dorsal-fin green with black spots; Pectoral- and ventral-fins orange; anal-fin green-orange, edged with white; adipose-fin having a bright margin of pinky-red, the same colour as the red spots on the body; tail-fin orange-green, top and bottom edges fringed with orangey-red.

Fin-rays: D. 14: P. 14: V. 9: A. 11: C. 19.

[1] The pyloric cæca are narrow pouches or *culs-de-sac*, more or less numerous, attached to the pylorus or mouth of the intestines.

THE GREAT LAKE TROUT.[1]

THE points in which this fish differs from the Common Trout, and also the distinctions by which it may be most easily recognized, have been already given in the chapter on Salmon.

The Great Lake Trout, which is perhaps best known to anglers as the species for which Loch Awe has always been famous, is probably distributed throughout almost all the larger and deeper lochs of Scotland. It occurs to my knowledge in Lochs Ericht, Lochy, Garry, and Laggan, and it has also been recognized in Loch Shin, in Lochs Loyal and Assynt, and amongst some of the Orkney and Shetland Islands. In Ireland it appears to be an inhabitant of all the best-known and most extensive lakes, having been found in Loughs Mask, Melvin, Erne, Corrib, and Neagh, where it is locally named *Buddagh*, the younger

[1] *Salmo ferox*. *Salmo*, a Salmon or Trout; *ferox*, fierce, Lat.

THE GREAT LAKE TROUT *(Salmo ferox)*

To face page 58

and smaller-sized fish being termed *Dolachans*. It is the *Ullswater Trout* and Grey Trout of the English Lake-districts, referred to by Dr. Heysham, and was at one time, it appears, erroneously considered to be identical with the Great Trout of the Lake of Geneva—a theory contradicted by Agassiz, who pronounced it to be distinct from any of the large Continental species.

The specific name *ferox* has been given to this fish from its extraordinary fierceness and voracity, which are such that, having once seized a bait, it will allow itself to be dragged by its hold for forty or fifty yards, and when accidentally freed will immediately seize it again. The stomachs of the specimens that I have caught have been constantly found gorged with food. The only way of taking the larger fish is by spinning with a Loach, a small Parr, or other glittering bait trailed behind a boat, for which purpose very powerful tackle is required, as the fish is of immense strength, and its teeth are nearly as sharp as those of a Pike.

The Great Lake Trout is almost wholly confined to lochs and deep extensive tracts of water, where it reigns in solitary grandeur, seldom venturing far up or down the streams, and never descending to the sea. It spawns in September.

Principal Characteristics of the Great Lake Trout.—Length of head compared to total length of head, body, and tail-fin, about as 1 to $4\frac{1}{2}$; depth of body less than length of head. Teeth large, strong, and numerous, arranged in six rows above

and four below—two of the upper rows extending along the vomer. Origin of back-fin halfway between point of nose and commencement of upper tail-fin rays; third ray of back-fin longest, and equal to length of base of fin; small back-fin halfway between last ray of large back-fin and end of tail-fin, and directly over origin of last ray of anal fin. Fins generally rather small and muscular. Colours when in season: upper parts and back-fin deep purplish brown, changing into reddish grey, and thence into fine orange on breast and belly; whole body when fresh out of water as if glazed over with a tint of rich lake-colour. Gill-covers and back-fin marked with large dark spots, and whole body covered with markings of different sizes and varying in number in different individuals, being sometimes scattered and of large size, and at others thickly set and of small dimensions. Each spot surrounded by a paler ring occasionally of a reddish hue. Spots becoming more scattered below lateral line; none on belly. Pectoral, ventral, and anal fins yellowish green, darker towards the extremities. Tail of great breadth and power—broader than greatest depth of body, slightly forked when young, becoming square with age; in very old fish slightly convex. Pyloric cæca from 34 to 49 in number. Scales thin and flexible, different in form from those of the Trout, and more circular than those of any of the migratory species.

Fin-rays in specimen from Loch Awe: D. 13: P. 14: V. 9: A. 11: C. 19.

In specimens from Lough Neagh, one ray less in D., P., and A. fins, and one ray more in C. fin.

The only remaining British representatives of the genus *Salmo*,[1]—viz., the Charrs—being, like the *ferox*, exclusively inhabitants of Lakes, may appropriately receive in this connection a few words for the sake of completeness; although,

[1] Or true Salmon and Trout species.

unfortunately for the Angler, not coming strictly under the denomination of "Sporting Fish." Indeed, the species of this very beautiful group rarely take either bait or fly: so rarely that, amongst all the lakes, lochs, and loughs I have fished in all parts of the three kingdoms, I never actually caught an undeniable Charr but once, and that was in a little ghastly-looking, deep, black "tarn" on the top of a mountain in Inverness, during a snowstorm.

At least five distinct species of Charrs, inhabiting different localities in the British Islands, have, however, been identified by Dr. Günther, who has written a series of most interesting and beautifully illustrated papers on the subject. These species are—1. *Salmo Cambricus*, the Welsh Charr. 2. *Salmo Willughbii*, the Windermere Charr. 3. *Salmo Grayi*, the Grey Charr, or Fresh-water Herring of Lough Melvin, Ireland. 4. *Salmo Alpinus*, the Northern Charr, found in Lake Helier, Hoy, Orkneys, and probably in other Scotch waters; and 5, *Salmo Colii*, found in Loughs Esk and Dan, Ireland.

As a Division or Group the Charrs may generally be distinguished from the two other sections of the same genus by the brilliant tints of the belly, which increase in vividness as the spawning-season approaches, and by the comparatively very minute size of their scales.

THE GRAYLING.[1]

ALTHOUGH a well-known and beautiful member of the Salmon family, the Grayling belongs to a different genus to the preceding groups, which all follow the true Salmon and Trout as their types. Its generic characteristics are : two back-fins ; the base of the first very long, with numerous rays ; the second small and adipose, without rays. Mouth small, with a squarish orifice ; teeth very small and conical ; air-bladder large ; body elongated. Gill-rays seven or eight.

In the "Angler-Naturalist,"[2] in my remarks on the Grayling, I observe that—"Whilst yielding to its sister species the Trout in the qualities of dash and obstinate courage, the Grayling is yet a sturdy and mettlesome fish—'a foeman worthy of

[1] *Thymallus vulgaris*. *Thymallus*, "thymy"—from *thymum*, thyme, and *vulgaris*, common, Lat.

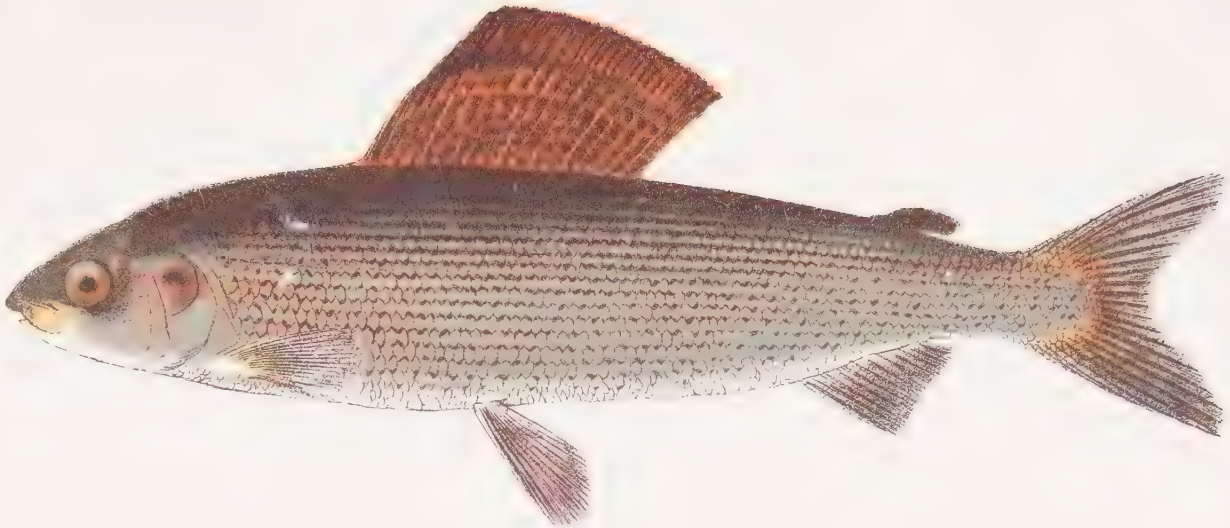
[2] "A Popular History of British Fresh-water Fish," or the "Angler-Naturalist." London: Routledge and Sons.

our steel;' and if the former is the handsomer, the latter must, I think, be admitted to be the prettier species of the two. The Trout has, so to speak, a Herculean cast of beauty; the Grayling rather that of an Apollo—light, delicate, and gracefully symmetrical."

Though abounding in some streams, the Grayling is a remarkably local and even comparatively rare fish, thriving best in rivers the bottoms of which are composed principally of sandy gravel or loam—a soil highly favourable to the production of the insect food on which it in a great measure subsists. Rocky or stony bottoms are very inimical to its breeding; and this is probably the reason why, though flourishing in many Continental waters, so few exist in those of Ireland or Scotland. Indeed, even in England, a dozen names or so include all our streams which have any right really to be considered as properly Grayling-waters; and these, with hardly an exception, belong to the southern and western portions of the island. The fact is no doubt accurately stated by Mr. Blaine when he says, "Grayling require other peculiarities of location besides those of temperature, such as, for instance, the general character of the water they inhabit, and certain circumstances in the nature of its composition derived from its sources. It is probably owing to the abstraction of some of these requisites that the breeding of the fish in several rivers in which they have been attempted to

be naturalised has not been attended with much success. In some they soon disappeared; in others they remained, but never thrived; while in some waters, though they lived, and at first increased, yet they were afterwards observed to shift their quarters to different grounds, in most of which cases it proved, as in the Test of Hampshire, that they migrated from above downwards, probably in search of deeper and more tranquil waters: for the angler cannot fail to observe that Grayling do not, like Trout, affect very rapid shallows and the coldest torrents; on the contrary, they seem to thrive best where milder currents alternate with deep and extensive pools." On these rapids, however—or "stickles," as they are termed—small Grayling may frequently be found, but the large fish rarely, except in the spawning-season. The haunts of large Grayling are the deepish and slowly-running tails of streams or pools, a few yards before the formation of fresh shallows; and here they will be found *at all times*, except when spawning.

It has been asserted that the Grayling is not, like the Trout, indigenous to this country, but was introduced by the monks on account of its edible qualities—a supposition to which the peculiarity of the local distribution doubtless gave rise. The following is a list of the best known Grayling waters, though I will not say that there may not be others with which I am unacquainted :—



THE GRAYLING (*Thymallus vulgaris*

To face page 64

In Hampshire and Wiltshire the Grayling is found in the Test, the Itchen, and in both the Avons, &c.; in Herefordshire, in the Teme, the Lug, the Wye, and the Arrow; in Shropshire, in the Teme and Clun; in Staffordshire, in the Hodder, the Trent, the Dove, the Blythe, and the Wye; in Derbyshire, in the Dove; in Merionethshire, in the Dee, between Curlen and Bala; in Lancashire, in the Ribble; in Yorkshire, in the Derwent, near Scarborough, in the Yore, the Wharfe, and in the Whiske, near Northallerton, in the Rye, Swale, Costa, and (Yorkshire) Dove, near Pickering; in Berkshire, in the Kennet, at Hungerford; and in Cumberland, according to Heysham (but this appears doubtful), in the Esk and the Eden. In Scotland the Grayling may now be considered to be established in the Clyde, and it has also been recently caught in the Annan, as recorded by a writer in the "Fishing Gazette."

The Teme Grayling has the reputation of being the finest in England, and when in the height of condition—that is, in October or November—and just taken from the water, is certainly one of the most beautiful fish that can be imagined. At this time the back is of a deep purple colour, with small dark irregular spots on the sides; the stomach is brilliantly white, with a fringe or lacing of gold; the tail-, pectoral, and ventral fins are of a rich purplish tint. The dorsal fin is very large—almost disproportionately so—and is covered with

scarlet spots and wavy lines upon a dark ground of reddish-brown. The little velvet back-fin near the tail is also dark brown or purple, and the whole body is shot with violet, copper, and blue reflexions when seen in different lights. Properly to appreciate this colouring, the fish should be laid horizontally upon the hand to be looked at, in which position its varied tinting is seen to the greatest advantage.

In addition to its delicate colouring, the Grayling has been supposed to possess a peculiar thymy smell, from which it takes its specific designation. The English name, "Grayling," is probably a modification of "Grey-lines," in reference to the longitudinal dusky-blue bars with which its body is marked.

In size Grayling vary according to locality; but they rarely exceed 3 lbs. in weight, and by far the greater number of those taken are under 1 lb. Occasionally, however, they are met with of even a larger size than that above named: Mr. T. Lister Parker took three fish in the Avon, near Ringwood, which together weighed 12 lbs.; a Grayling of 4½ lbs. weight was killed in the Test, and one of 5 lbs. is *recorded* to have been taken in the neighbourhood of Shrewsbury.

No doubt the possible ultimate growth of the Grayling depends upon the amount and quality of its food, which, besides flies, worms, caterpillars, etc., consists of the larvæ of dragon-flies, May-flies, and other ephemera.

Unlike the rest of its congeners of the Salmon family generally, the Grayling never jumps out of water, and is apparently unable to surmount either natural or artificial obstructions or to stem very rapid torrents, being, in fact, much more prone to going down than up the stream. It has the power, however, of raising itself rapidly to the surface, and of descending again with stone-like velocity—a faculty which has been ascribed to the action of the large dorsal fin striking either upwards or downwards against the current, but which is more probably attributable to the unusual size of the swimming- or air-bladder.

The eggs are numerous but considerably smaller than those of the Trout, being about the size of partridge-shot, and when viewed in the rays of the sun having very much the colour of the opal. The body of the embryo fish becomes distinctly visible in about nine days, and the egg itself hatches in fourteen or fifteen days from the date of deposit,—results obtained in the case of the eggs of the Trout in about thirty-five and fifty days respectively.

The spawning-time is in April or the beginning of May, the fish getting into condition in July, and reaching its prime in October and November, when most of the other *Salmonidæ* are going off. The Grayling has, moreover, according to Sir Humphry Davy, the advantage of rarely being so much out of season as to be unfit for food or un-

willing to take a bait if judiciously offered. This author, who has supplied a very fair history of the fish, considered that it might be taken at all times of the year, and that when there were flies in the water it would generally rise to them.

The specimen from which the illustration is taken, was a beautiful Teme fish about a pound and a half in weight. Its proportions were:—The total length of the head, body, and tail-fin, being considered as $5\frac{1}{2}$, the length of the head alone as one. Depth of body for about half its length slightly greater than the length of head; tail forked. Number of scales in lateral line, 27.

Further Characteristics of the Grayling (as found in a specimen 10 inches long).—Head small and pointed, flattened at the top. Between point of nose and commencement of first back-fin equal to one-third entire length, tail-fin rays excluded. Back-fin very long at the base, nearly equal to twice the length of its longest ray; pectoral fins long, narrow, and pointed; ventral fins commencing directly under centre of back-fin; anal fin commencing halfway between origin of ventral fins and fleshy part of tail. Opening of mouth when viewed in front squarish; teeth small, numerous, and curved; none on tongue, and only a few on end of vomer, or central bone in roof of mouth, and on the adjoining ends of the bones of the palate, situated in single rows on the jaws. Profile of back slightly convex, that of belly nearly straight. Scales large, seven in an oblique row above the lateral line. Vertebræ 58. Colour: sides marked with about 15 dusky longitudinal bands or bars; the general hue becomes darker with age, and about the spawning-season the pectoral fins are reddish with small black spots: for further remarks on colouring see p. 65.

THE PIKE.[1]

THE Pike, of which we have only one recognized species in this country and on the Continent, is common to most of the rivers and lakes of Europe and North America, and the Mascalonge (*Esox estor*) and the Northern Pickerel (*Esox lucioides*)—both inhabitants of the great lakes; the common Pickerel (*Esox reticulatus*)—indigenous to all the ponds and streams of the Northern and Midland States; the Pickerel of Long-Island (*Esox fasciatus*)—probably confined to that locality; the White Pickerel (*Esox vittatus*), the Black Pickerel (*Esox niger*), and *Esox phaleratus*—all inhabitants of the Pennsylvanian and Western waters, have been generally recognized as distinct species. Of these the first two are the types, the others following, more or less closely, the same formation as to comparative length of snout, formation of the lower jaw, dental system, gill covers, &c.

As regards the European Pike, it seems probable that there may be varieties yet to be dis-

[1] *Esox lucius*—*Esox*, a Pike; *lucius*, *the* Pike, Latin names.

covered, as Dr. Genzik, the well-known naturalist of Lintz, informed me that he had found some specimens which had teeth like the fangs of a viper—capable of being erected or depressed at pleasure,—a circumstance the more remarkable as the jaws also of the Pike are furnished with extra bones to increase the size of its gape, very similar to the corresponding bones in the Viper-conformation.

Indigenous in all climates which are not tropical, a chilly or even frigid latitude is apparently essential to the well-being of the Pike. Thus in Norway and Sweden, Siberia, and the lakes of Canada and Lapland it reaches its full development, breeding in vast numbers, and commonly attaining the length of 4 or 5 feet, whilst it rapidly degenerates on approaching warmer latitudes—diminishing in geographical distribution with the spruce fir, and ceasing entirely in the neighbourhood of the Equator

Of the numerous names by which the Pike is known the common term "Pike," or "Pickerel," is probably the only one derived from our own language; and this would appear to have originated in the Saxon word *piik*, signifying "sharp-pointed," in reference doubtless to the peculiar form of the Pike's head—or possibly teeth?

In Sweden the fish is named *Gädda*, and in Denmark (amongst other variations) *Gedde*, apparently identical with the Lowland Scotch, *Gedd*,

THE PIKE (*Esox lucius*)

though spelt somewhat differently. M. Valenciennes has published a long list of the names which the fish bears amongst the Sclavonic and Tartar races, but none of them seem to have any relation to those by which it is known on the western coasts of Europe.

The Pike is the *Brochet* of the French, by whom it is also called *Brocheton*, *Lance* or *Lanceron*, and *Becquet*—the last having reference doubtless to the flattened or duck-bill-like form of the muzzle.

The ancient classical name of the Pike was *Lucius*,[1] under which it is mentioned by several old writers; and from this root have doubtless sprung the terms *Luce* or *Lucie* (the "White Lucie" of Shakespeare and of heraldry), as well as the *Luccio* or *Luzzo* of the Italians.

To the ancient Greeks, so far as we are aware, the Pike was a stranger; or if known, has escaped notice in the writings of Aristotle. In the works of several Latin authors it is mentioned, and is stated to have been taken of very great size in the Tiber; but it has been doubted by naturalists whether this fish—the *Esox* of Pliny—is synonymous with the *Esox*, or Pike, of modern ichthyology.

[1] Nobbes suggests that the name *Lucius* is derived "either *a lucendo*, from 'shining in the waters,' or else (which is more probable) from *Lukos*, the Greek word for *lupus:* for as," says he, "the wolf is the most ravenous and cruel amongst beasts, so the Pike is the most greedy and devouring among fishes. So that *Lupus Piscis*, though it be proper for the Sea-wolf, yet it is often used for the Pike itself, the Fresh-water Wolf."

Ausonius, however, living about the middle of the fourth century, clearly alludes to the Pike in his well-known lines:—

> "Lucius obscurus ulva lacunas
> Obsidet. Hic, nullos mensarum lectus ad usus,
> Fumat fumosis olido nidore popinis."

The age to which the Pike will attain has been always a debated point amongst naturalists. Pennant mentions one ninety years old. Pliny considered it as the longest-lived, and likely to reach the greatest age, of any fresh-water fish; while Sir Francis Bacon, agreeing in this view, yet limited its probable maximum to forty years.

In natural connexion with this part of the subject—the limit of age in the Pike—occurs that of its probable growth and size when suffered to attain to full development. It has been the custom amongst modern writers to affect a civil disbelief in the accounts of very large Pike handed down to us by numerous credible witnesses; and the prevailing impression appears to be that a weight of 30 or 40 lbs. is about the real maximum attained. I could easily refer, however, to many attested examples of Pike having been taken in the British Islands up to the weight of 70, 80, and even 90 lbs.; but a single instance, too well authenticated to admit of doubt, will suffice. I refer to the case of the Kenmure Pike—mentioned also by Daniel in his "Rural Sports," and by Dr. Grierson and other authors—the weight of which

was 72 lbs. It was taken in Loch Ken, Galloway, a sheet of water belonging to the Castle of Kenmure, *where the head of the fish is still preserved*, and may be seen by any one sufficiently curious or sceptical to desire ocular demonstration. To give a general idea of the size of the Pike, I may quote one measurement—that across the back of the head,—the width of which was *nine inches*.

Dr. Genzik, who gave me some valuable information concerning the Continental Pike, states that, in the fish-markets of Vienna, Lintz, and Munich, Pike are not unfrequently exposed for sale of 80 and 90 lbs. weight and upwards,—that the fishermen on the Danube, near Strudel and Wirbel, have legends of specimens 15 and 20 feet long, which break through all their nets,—and that at Traunkirchen, on the Gmünden Water, there are still living some fishermen who declare that on one occasion when dragging the lake they enclosed a Pike longer than either of their boats, and that they began, as they expressed it, "to say their prayers, thinking the enemy was on their nets; the Pike, however, with one spring, jumped over the nearest boat and escaped"!

At Oberneukirchen Dr. Genzik himself saw a Pike taken out of a large tank or preserve, which after being cleaned, weighed 97 lbs. and some ounces; and an officer of Tyrolese Rifles informed him that whilst at Bregentz during the past au-

tumn (1862), he was present when a Pike was caught weighing upwards of 145 lbs.

After this we may be inclined to give more credence to Bloch's statement that he once examined a portion of the skeleton of a specimen which measured eight feet.

The rate of growth of the Pike has been by different authors variously estimated at from 1 to 5 lbs. a year; but these estimates do not, generally, appear to be based on any very reliable grounds, still less upon actual experiment, and therefore go but a little way towards advancing our knowledge of the subject. My own experience leads me to believe that the growth-rate is susceptible of very great variation, depending upon the nature of the water and the amount of food supplied to the fish, but that in the open waters—at least in England—it seldom averages more than 1 lb. a year during the first two years, and from $1\frac{1}{2}$ to 2 lbs. a year afterwards, decreasing again after eight or nine years to about the original ratio. This average cannot, of course, be taken as any index of what may be done by keeping Pike in rich preserves or fattening them in stews, as the capacity of the Pike for food is well nigh inexhaustible, and is in analogy with its digestion the marvellous rapidity of which has been aptly described as resembling the action of fire.

Of one point, however, I have fully convinced myself, viz. that during the first year the maximum

growth, in open waters, does not much exceed half a pound. The grounds of this conclusion are briefly as follow :—Pike spawn in March or April : in June, when Pike-fishing commences, I have not unfrequently taken, and seen taken, with the net, small Jack of about *an ounce*, or a little more, in weight ; in September, again, I have constantly taken them, with a minnow, of *three or four ounces ;* and in January and February specimens of from *five to seven ounces ;* whilst I have never within my memory caught the smaller-sized fish at the later periods, or *vice versâ*,—thus pointing clearly to the inference that at these seasons there were young Jack of those respective sizes, and none others—in other words, that the different sizes represented the different stages of growth. These I believe to be the fish of about $\frac{3}{4}$ lb. of the following season.

The Pike is a true cosmopolitan in his feeding. Fish, flesh, and fowl are alike acceptable to him. Animal, mineral, and vegetable—his rapacity devours them all. Lord Walsingham writes to me that he once caught a pike with a hare's foot, and on another occasion with a dead rat! Nothing, in short, that he can by any means get into his stomach comes amiss to him ; and imperial man himself has on more than one occasion narrowly escaped being laid under contribution to his larder. His own species enjoy no immunity from this universal rapacity ; on the contrary, it has been asserted

that more young Jack are destroyed by their own parents than by any or perhaps all other enemies put together.

A remarkable instance of this characteristic propensity was communicated to me by Mr. L— of Chippenham, Wiltshire, to whom the incident occurred. This gentleman had set a trimmer in the River Avon over night, and on proceeding the next morning to take it up he found a heavy Pike apparently fast upon his hooks. In order to extract these he was obliged to open the fish, and in doing so perceived another Pike of considerable size inside the first, from the mouth of which the line proceeded. This fish it was also found necessary to open; when, extraordinary to state, a third Pike of about ¾ lb. weight and already partly digested was discovered in the stomach of the second!

Of the indiscriminating character of the Pike's appetite a more apt illustration could not perhaps be given than the following, kindly communicated to me by Lord Walsingham, who is himself an enthusiastic angler and a close observer of nature:—

"A newly cut ash-pole, with the bark peeled off for a few inches at the small end, was lying across the punt in which I was fishing, the pole was somewhat bent, and owing to the wind and my movements in the boat, the end frequently dipped in the water. A Pike dashed at it and seized it, leaving the marks of his teeth distinctly visible in the wood."

Another amusing instance was related to me by an eye-witness:—Upon a piece of water belonging to Wandle House, Wandsworth, some toy vessels were being sailed, at the stern of one of which was attached a small boat fancifully decorated with green and gilding. As the little craft swept briskly across the pool, with her boat in tow, a Pike suddenly darted from the water and seized the boat in his jaws, well nigh capsizing the whole flotilla in his efforts to drag his capture to the bottom. To this task, however, his strength was apparently unequal, and a fresh breeze springing up, the submerged nautilus reappeared on the surface and continued her voyage, but had hardly got fairly under way when the Pike again dashed forward to the attack, seizing her as before, and repeating the performance until the boat grounded on the opposite bank.

It has been mentioned that in rare instances and when under the influence of either extreme anger or hunger, Pike have been very clearly convicted of attempted manslaughter. Such being the case, it is hardly necessary to say that it is by no means uncommon for animals, often of large size, to be similarly attacked, and, in the case of the smaller species, devoured, by this fish. Accounts are on record of otters, dogs, mules, oxen, and even horses being assaulted. Poultry are constantly destroyed by the Pike,—"the dwellers in the 'Eely place,'" as Hood punningly says,

"having come to Picc-a-dilly." I have seen a Pike take a pigeon that I had myself shot from a pontoon at the Welsh Harp—the circumstance indeed was witnessed by a number of people. Lord Walsingham writes to me:—"Partridge shooting near a large piece of water I wounded, late in the evening, a bird, which flew in the direction of the water; the next day I was Pike fishing, and about fifty yards from the land, just opposite where the wounded bird must have reached the water, I caught a Pike of about 8 lbs. with a partridge in his stomach—undoubtedly my bird. I discovered it by seeing feathers sticking out of his throat while extracting the hooks." Sometimes the heads of swans diving for food encounter instead the ever-open jaws of this fish, and both are killed; whilst among the frogs he is the very "King Stork" of the fable. He will even seize that most unsavoury of all morsels, the toad, although in this case the inherent nauseousness of the animal saves it from being actually swallowed,—its skin, like that of the lizard, containing a white highly acid secretion which is exuded from small glands dispersed over the body.

Pike will attack both the land- and water-rat; occasionally pouching them, but more frequently treating them as in the case of the toad,—a fact confirmed by Captain Williamson, who adds: "But whether owing to the resistance that animal (the rat) makes, which I have witnessed to be very

fierce—and that under water too—or whether owing to the hair or scent displeasing them, I know not; but they do not appear to be very partial to the quadruped."

Sometimes the Pike lies in ambush, protruding only its eyes and grim muzzle through the weeds, when the movement of seizing a victim is little beyond a quick turn of the body and an opening and shutting of the jaws; but generally he takes his prey with a rush and a flash, emerging so suddenly and with such startling energy, that I have, in more than one instance, known a Troller literally drop his rod from the effects of sheer terror.

Woe to the fish or flesh that gets once fairly enclosed between the jaws of a Pike! From that more than Regulus-like incarceration it rarely effects its escape. Like the Remora, which will allow itself to be cut to pieces rather than relinquish its hold, the Pike exhibits an extraordinary tenacity of purpose and reluctance to quit its grasp of a prey once seized.

A Pike will even constantly make a considerable fight, and actually allow itself to be dragged many yards by the obstinacy of its hold, without ever having been pricked by a hook—shaking the bait out of its mouth perhaps when almost in the net. I have witnessed the same thing to occur with a cork ball tied to a string and drawn across a stock-pond.

This mixture of determination and ferocity

makes the Pike the undisputed master of our fresh waters, although it has been asserted that, from its superior momentum, a Trout or Salmon of equal weight would have the advantage in a pitched battle. I doubt it much. What chance these fish have against the Pike is shown by the effect of introducing the latter into trouting and salmon waters, where the new-comer speedily dispossesses the rightful tenants. Witness, for instance, the ravages committed in the Canterbury River, in the Wandle, in the Colne near Draycot and Cowley, in the Teviot, and in Lochs Katrine, Lomond, Awe, and Jurit in Scotland; and the same thing is known to have taken place in many of the best Irish waters, where the Pike is still continuing to spread and multiply, displacing by degrees the Trout and other indigenous races.

Indeed, how Pike spread is a problem which it has perplexed naturalists to explain. A stream, or pond, or loch, reserved perhaps for centuries to the docile phlegmatic Carp, or "star-stoled Trout," suddenly begins to show symptoms of a falling off; the next year matters are worse; the water is dragged, and the first fish to come up in the net is probably a Pike. How the Pike came there, or who put it there, remains unexplained; but the cause of the depletion of the water is no longer a mystery. Some authors have accounted for these singular immigrations by supposing that the Pike, like the Eel, actually travels overland in wet

weather from one pond to another; and several curious circumstances, which have come to my knowledge, would appear to lend some colour to the supposition.

In order to test the migratory theory, Mr. Newenham, an English resident at Antwerp, had two small ponds excavated near together, and stocked one with Pike, and the other with small Roach, Dace, &c. At the end of the second day he caused both ponds to be emptied, when it was found that several of the Pike from pond No. 1 had made their way by some means into pond No. 2, and had destroyed a great part of the fry.

A singular fact, pointing indirectly to the same conclusion, once came under my own observation. A pool five or six yards square, for the reception of small fish, had been constructed close to a stew-pond containing Pike; the work had been finished in the afternoon, and the pond left to fill. On visiting it the next morning, I was surprised to find it already occupied by a Jack of about ¾ lb. weight, which had contrived thus early to take possession.

The sudden appearance of Pike at certain times is not less remarkable than their unaccountable disappearance at others. There is no doubt that in seasons of great heat or unusual drought, when ponds or reservoirs have become rapidly dried up, the Pike that were in them have vanished in a very extraordinary manner, and that upon the return of the water they have been immediately

found in apparently undiminished numbers—a phenomenon, however, by no means confined to *Esocidæ*, as the same thing has been observed with regard to Carp and Tench; and Eels it is well known frequently make comparatively long journeys "overland."

Although from its vigorous and unsparing destructiveness the Pike has many detractors and few apologists, it must not be supposed that it is altogether without any of the softer instincts. On the contrary, it has been known to exhibit under particular circumstances a very decided amount of friendship, and even affection, especially in the conjugal form. The "one virtue," however, to which, amongst a thousand crimes, the name of the Pike has been specially linked is gratitude: it has been asserted that he never attacks his physician, the Tench. To this subject I have referred in the notice of the latter fish.

The haunts of Pike vary considerably at different times of the year, and also vary with the nature of particular waters; but it usually prefers a still, unfrequented spot, plentifully supplied with weeds and flags, selecting if possible a gravelly or sandy bottom. The neighbourhoods of reeds, docks, bulrushes, and the broad-leaved water-lily are its favourite resorts; and of these, a flooring of lilies, with from four to six feet of quiet current over it, and a wall of reeds at the side, springing from the bottom, is the best—

"A league of grass washed by a slow broad stream
That, stirr'd with languid pulses of the oar,
Waves all its lazy lilies and creeps on. . . ."

Indeed, it may be said that the reed and the lily are to the Pike what the hollybush is to the woodcock. In lochs and meres it commonly frequents the most shoal and weedy parts, small inlets and little bays, or the mouths of streams where minnows or other fry congregate; and in rivers, back-waters and dam-heads, eddies between two streams, or in fact any water that is weedy, of moderate depth, and not too much acted upon by the current. As a general rule, Pike will be found during the summer in or close upon the streams, and in winter, after the first heavy flood, in the large eddies and deeps. At the latter season the fish feed best about midday, with a breeze and a warm sun; and in the summer months at morning and evening with a cloudy sky and plenty of wind. A hot, sultry day is always inimical to success in Pike-fishing; as also a muddy or flooded state of the water: a full water, however, if not discoloured, is very favourable.

When in high season, the general colour of the Pike is green spotted with bright yellow, whilst the gills are of a vivid red; when out of season the green changes to a greyer tint, and the yellow spots become pale. It spawns about March or April, according to the climate, forwardness of the spring, and other local circumstances,—the young

females of three or four years old taking the lead and the dowagers following. For this purpose they quit the open waters in pairs, and retire into the fens, ditches, or shallows, where they deposit their spawn amongst the leaves of aquatic plants; and during this period the male may often be observed following the female about from place to place, and attending upon her with much apparent solicitude. As many as 80,000 eggs have been counted in one fish. When the spawning-process is complete the fish return again into the rivers, and are then for some weeks in a state of partial stupefaction, and unfit for food. In streams they begin to be in condition again about June, and are in their best season in November; but in still waters the recuperative process is much slower.

Characteristics of the Pike Family.—Head depressed, large, oblong, blunt. Body elongated, rounded on the back; sides compressed, covered with scales. Dorsal fin placed very far back, over anal fin. Jaws, palatine bones, and vomer furnished with teeth of various sizes.

Principal Characteristics of the common Pike.—Body elongated, nearly uniform in depth from head to commencement of back-fin, then becoming narrower; body covered with small scales; lateral line indistinct. Length of head compared to total length of head, body, and tail, as 1 to 4. Back- and anal fins placed very far back, nearly opposite each other. From point of nose to origin of pectoral-fin, thence to origin of ventral fin, and thence to commencement of anal fin are three nearly equal distances. Pectoral and ventral fins small; rays of anal fin elongated. Tail somewhat forked. Shape of head long, flattened, and wide; gape extensive. Lower jaw longest, with numerous small teeth round the front. The sides with five or six very large and sharp

teeth on each side. Upper jaw somewhat duck-billed. Teeth on vomer small; on the palatine bones larger and longer, particularly on the inner edges: none on superior maxillary bones. Head covered with mucous orifices placed in pairs. Cheeks and upper parts of gill-covers covered with scales. Colour of head and upper part of back dusky olive-brown, growing lighter and mottled with green and yellow on sides, passing into silvery white on belly; pectoral and ventral fins pale brown; back-, anal-, and tail-fins darker brown, mottled with white, yellow, and dark green.

THE PERCH.[1]

CUVIER has taken the Perch as the type of his leading genus. In other words, it is the first Species, of the first Genus, of the first family, of the first Order, of the first Series of fish in his systematic classification. In the present essay, however, I have found it on the whole more convenient not to adopt the strictly ichthyological sequence in referring to the different species of sporting fish, and the Perch here takes his place not according to family 'descent,' but as naturally following after the Pike, with which in actual sport he is so constantly associated.

The Perch—the common Perch of our ponds and rivers—is very generally distributed over almost the whole of Europe and Great Britain, and is one of the most generally recognized inhabitants of English waters from the Tweed to the Land's End. In Wales it is a somewhat local fish, and confined principally to stagnant waters; in Ireland more widely diffused, though still in distribution

[1] *Perca fluviatilis*. *Perca*, the Perch; *fluviatilis*, of the river, Lat.

PERCH. (*Perca flavitilis.*)

To face page 86.

rather unequal; in Scotland very general south of the Frith of Forth and comparatively rare to the north of it, ceasing entirely amongst the innumerable waters of Sutherland and Ross, or, where observed, owing its introduction to very recent times.

Of the British Perch, so far as my experience extends, the Thames produces the best in the matter of quality; Windermere, and Slapton Ley, in Devonshire, the greatest show as to quantity; and the Kennet from Hungerford to Reading, or perhaps the Avon below Sommerley, the finest specimens for general size and weight. The numbers of Perch in Windermere and Slapton Ley are almost incredible: but their size is commonly insignificant.

The Perch of the Thames, which is also noticeable for its fine colouring, probably owes its superior gastronomic attractions to the great purity of the stream above locks as well as to the wide range in the choice of food, spawning-ground, &c., which it affords; but in whatever waters the fish is bred it is seldom other than palatable as well as wholesome, and it is on this account a frequent item in the invalid's dietary. "More wholesome than a Pearch of Rhine," says a German proverb mentioned by Izaak Walton, who also quotes a learned authority to the effect that it possesses a small stone in the head thought to be very "medicinable."

The Perch selected for illustration was a Kennet fish of 3 lbs. weight—one of the most perfectly shaped specimens that I ever met with.

The Perch lives long out of water (resembling in that respect Carp and Tench), and if carried with care and occasionally moistened will, in cold weather, exist for several hours in this condition. Yarrell says that Perch are constantly exhibited in the markets of Catholic countries,—where doubtless they are a popular article of "fast;"—and that on these occasions, when not sold, they are taken back to the ponds from which they came to be remarketed at another opportunity.

The size to which the Perch will attain is somewhat doubtful. The largest specimen that I ever remember to have met with was preserved in a small inn in Perthshire. It was very imperfectly stuffed, and had no doubt shrunk considerably in the operation; but the label stated that it weighed 7 lbs. when caught, and from its appearance it certainly could not have weighed less than five or six. Perch of 2 and 3 lbs. are by no means uncommon, and specimens of even 4 lbs. are probably less rare than may be supposed. Such fish have been taken in the Pen Ponds, Richmond Park; and Pennant records the capture of one in the Serpentine which weighed 8 lbs. Donovan speaks of a Perch of 5 lbs., caught in Bala Lake. One of 6 lbs. was taken by Mr. Hunt, of Brades, Staffordshire, from the Birmingham Canal; and two fish of 8 lbs. each

are stated to have been caught, the one in the Wiltshire Avon, and the other in Dagenham Reach, Essex. One is recorded by Izaak Walton as having been taken by a friend, which measured two feet in length; and in the "Sure Angler's Guide," the author says that he saw the figure of a Perch drawn in pencil on the door of a house near Oxford, which was twenty-nine inches long, and he was informed that it was the outline of a living fish.

It is not probable, however, that either of these sizes represents the maximum attainable by the Perch under favourable circumstances, even in British waters; and it probably reaches a much greater weight in Scandinavia and other northern countries. The Danube breeds enormous Perch; and in the Church of Lulea, Lapland, the head of one is preserved which is nearly a foot long—giving the entire length of the fish at somewhere about $3\frac{1}{2}$ feet.

After the Pike, the Perch is the most absolutely fearless of our sporting fish, often following a bait up to the very surface of the water or side of the boat, when with jaws open and spines erect he presents a really splendid appearance. He will often remain thus for several instants bristling like a porcupine, as if threatening reprisals on those who have baulked him of his prey—retiring at length in sullen wrath with his face still turned towards his assailants.

How far the spines of the Perch protect him from the assaults of other fish—especially of the Pike—is not quite certain. In many fishings both in England and Scotland small Perch are considered the favourite baits for the Pike, which does not seem to be at all deterred by their spiky appearance. Moreover, as the Pike always swallows his prey head-foremost, whilst the spines of the Perch are capable only of projecting backwards—shutting down like the props of an umbrella upon pressure from in front—it would appear that they ought rather to assist than impede the operation of swallowing.

The favourite food of the Perch consists of minnows, of which he can devour an extraordinary number; but failing these, any small fry, worms (especially brandlings), insects, frogs, caterpillars, and grubs of all sorts are good baits.

The extent to which he will gorge himself with minnows may be judged by the fact—within the knowledge of most anglers—that when he has filled his stomach so that he can positively swallow no more, he will still endeavour to bite and, if possible, masticate others; and it is by no means uncommon under these circumstances to hook and capture a Perch with the tails of the minnows which he has already partially swallowed, and been unable to pouch, protruding from his gullet! From this it may be inferred that fish, like many other animals—including man himself, in the first degree

—find a gratification in the exercise of their predatory instincts even when the appetite of hunger has been fully satiated.

Although having, it will thus be seen, the bump of destructiveness very liberally developed, Perch are by no means difficult to tame : Mr. Jesse succeeded, after a few days only, in inducing them to feed from his hand. Bloch mentions having watched them depositing their ova in a vessel kept in his own room; and I was informed by Mr. Bartlett, the eminent and indefatigable Superintendent of the Zoological Gardens in Regent's Park, that the Perch in the aquarium there increase their numbers by an annual shoal of young fry which are hatched and reared under the eyes of hundreds of visitors.

A comical anecdote turning upon this faculty of ready acclimatization is related by the author of "Fishes and Fishing." A country gentleman, in order to add to the usual attractions of a Christmas visit, offered a London friend of piscatorial tendencies the temptation of a "day's fishing in his private water." The sportsman arrived, with a good assortment of rods, lines, &c., and was all-impatient to be at his work. After lunch his host introduced the visitor to "his water"—which proved to be an ornamental basin, in width about equal to the length of one of the rods the angler had brought with him. The chagrin and disappointment of the latter may be imagined; but upon the

assurance that there really were fish in the pond, he put his tackle together and adjusted a bait. It had hardly touched the water before he hooked and landed a fine Perch; another and another followed, and by the time his friend came to summon him to dinner he had thirty-five fish in his basket. "Well," said his host, "I am glad you have had such sport; I caused three dozen to be put in the day before yesterday." "Indeed?" was the reply, —"then I will go back and catch the thirty-sixth after dinner."

Though attaining their greatest perfection in clear, sharp streams, Perch thrive well on clayey or sandy bottoms, preferring generally a water of a moderate depth and current, and frequenting holes, mill-dams, hollow banks, and, in summer, the under-currents of weirs. In winter their favourite haunts are back-waters and eddies; and at this time of the year they feed best about the middle of the day, more particularly if bright and warm. They usually swim in large shoals. Their spawning season is at the end of April or the beginning of May; and so prolific are they, that a specimen weighing half a pound has been found to contain 280,000 ova. The eggs are deposited in strings which hang about the weeds and rocks, and when seen through a bright sunlight present a beautiful appearance almost resembling festoons of pearls.

Of the Perch family only two fresh-water species

are known to exist in this country, the common Perch, and the Ruffe or Pope; the latter of little interest either for sport or for the table.

The characteristics known to all the *Percidæ* are:—Fin-rays partly spinous and partly flexible. Body oblong, and covered with hard or rough scales. Bones of the gill-covers variously armed at the edges with notches or spinous points. Most of the species composing this family have the ventral fins under the pectoral.

Principal Characteristics of the Perch.—The whole length of the fish,—head, body, and tail-fin—being considered as 1, the length of the head alone, to the point of the gill-cover, is about $3\frac{1}{2}$: depth of body at the deepest point as nearly as possible equal to length of head; nape of neck and shoulder rising very abruptly, giving a general appearance of the fish being rather "hog-backed;" belly-line less convex. Fleshy portion of tail very slender. Tail-fin rather small. Two back-fins, the first supported by strong pointed bony rays fourteen in number; the second back-fin having sixteen soft rays, and commencing very nearly over the anal fin: the commencement of the first dorsal, pectoral, and ventral fins, very nearly in a line, slanting slightly *backwards* towards the belly; and the pectoral-fin commencing a very little more forward than the point of gill-cover. Colour: muzzle dark brownish green; irides, cheeks, and gill-covers, a greenish bronze; pectoral-fins nearly yellow of a lightish tint; pectoral, anal, and tail fins, brilliant scarlet; second back-fin greenish, with a slight tinge of scarlet or orange. Back dark olive green, becoming nearly brown in large specimens; sides golden yellow marked with dark transverse bars of a greenish colour: belly from muzzle to tail quite white. Scales in lateral line about sixty-six. Lateral line convex.

THE COMMON CARP.[1]

THE family of Carps (*Cyprinidæ*) belongs to the first Order of fishes, *Malacopterygii*, or those having almost all their fin-rays soft and flexible, and the genus *Cyprinus*, or true Carps (the first genus of this family), are distinguished by—the body being always covered with large scales; a single long back-fin; the lips fleshy; mouth small; teeth in the throat, but none in the jaws; and three gill-rays. To the family *Cyprinidæ* belong no less than twenty-two species found by ichthyologists in our fresh waters; including the Roach, Dace, Chub, Barbel, and Bream, constituting some of the most prominent of the so-called "coarse fish," regarded as objects of interest from the sportsman's point of view.

The common Carp is the typical fish, and therefore occupies first place in right of precedence ichthyological. The specimen selected for illustration was taken from the Obelisk ponds in Windsor

[1] *Cyprinus carpio.* *Cyprinus*, a Carp; *carpio*, the Carp, Lat.

THE COMMON CARP *(Cyprinus Carpio)*

To face page 34

Great Park, which, with the adjacent preserves, have been for centuries famous for their Carp. I was informed by Mr. Frank Buckland, to whose kindness I was indebted for the opportunity of giving a representation of this fish, that on the occasion of its being captured, a series of five ponds near Cumberland Lodge were allowed to be run dry for the purpose of getting rid of the Jack. When the lowest pond—the Obelisk—was nearly empty the nets were put in, and from a conversation with Mr. Buckland on his return from Windsor I learnt some interesting particulars demonstrated by the result of the netting as to the growth-rate, &c., of the Carp in this and the other waters in Windsor Park. It was remarked as a singular circumstance that nearly all the Carp taken from the Obelisk pond were of a very similar weight, viz., from 4 lbs. to 6 lbs., none of them being of an unusual size, as was anticipated. Wheeler, Her Majesty's head fisherman, informed Mr. Buckland that he knew these Obelisk Carp to be fifty years old at least. They had been twice removed within his memory from the different ponds, the last time about thirty-five years before from a pond near Cumberland Lodge, when they weighed about 3 lbs. each. Their subsequent growth-rate therefore could not have averaged more than about an ounce a year.

It appears that some of the Windsor ponds are very much better suited to the growth, that is to the feeding, of Carp than others; thus, for in-

stance, Mr. Buckland was shown in the Royal Stew two Carp, brother and sister to those in the Obelisk pond, and of which the largest turned the scale at 10½ lbs.—having thus attained a size nearly double that of its less favourably situated relatives. This fish I examined. It had the appearance of being afflicted with an immense tumour in its abdomen, which the fisherman gave it as his opinion was caused by a detention of the eggs—a by no means uncommon occurrence according to his experience with very old Carp, "which were always bad breeders, and frequently retained their eggs for years." This opinion experiment proved to be correct, as, on making a *post mortem* dissection, three different sets of eggs, packed upon one another, were found,—those nearest the vent being of a white lustrous colour, and ready to be shed. They were of the usual size of Carp eggs. The other two sets of ova had, judging from their appearance, arrived almost at perfection in former years, but had never been shed. They were matted together inside the fish in a solid mass, presenting the aspect called in medical phraseology "Hepatization."

Although a slow-growing, the Carp is a very long-lived fish—the longest-lived, probably, of any fresh-water species—a hundred, a hundred and fifty, even two hundred years having been claimed as the term of its existence, when favourably situated. Admitting, however, that this last may

probably be an exaggeration, there is no doubt that many of these fish introduced into the ponds at Versailles, &c., during the reign of Louis the Fourteenth (say 1690) are either still living or were so but a short time before the Revolution of 1830. Dr. Smith, in his "Tour to the Continent," mentions them, and observes that they had grown white through age. Valenciennes refers to others in the Tuileries, which would also come when called by their names; and Buffon assures us that he had seen, in the fosses of the Ponchartrain, Carp which were known to be upwards of a century and a half old.

A reviewer in the "Athenæum" of the 8th of August, 1863, gives the following comical account of the Fontainbleau Carp:—

"Visitors to Fontainbleau will doubtless remember the lake adjoining the palace and its large Carp population, numbering many of the most ancient of that family in Europe. To those who have never been at Fontainbleau we may state that the lake swarms with these fish, of all ages and sizes, and that it is the custom of visitors to feed them with bread; but as ordinary bread would disappear in a moment among the hungry shoal, a plan has been devised to give the visitors more amusement by using balls of bread, about the size of a man's fist, baked to a biscuit-like hardness. On casting one of these balls into the lake, it is immediately surrounded by scores of Carp, hungry

youngsters for the most part, which being apparently aware that they cannot possibly devour the food in its hard and unbroken condition, proceed with wonderful unanimity to push it with their snouts to the nearest part of the stone wall confining the lake. Against this they continue butting it violently, until at length the repeated blows, and the softening effect of the water, cause the ball to break; when, just at the moment that it is in a fit state to be eaten, some half dozen enormous Carp, white with age, which have been watching the proceedings with evident interest, shoulder away the young workers, who retire with great precipitation, while the tyrants of the lake gobble or rather suck in the pabulum which has cost the small carp so much trouble to render fit for their eating. It is the old story of might against right, and as we have often witnessed what we have described, we have no doubt that old Carp are as wily as ancient foxes."

This gentleman, it will be observed, confirms Dr. Smith's statement as to the fact of Carp becoming gradually white from old age; and it is a curious fact that great age and exclusion from the light produce apparently the same effects both on fish and other animals—the skin or scales undergoing a sort of bleaching process, either from a gradual drying up of the invigorating juices of the body, or from the want of the sun's rays. In the case of fish and reptiles whitened by exclusion

from the light, it is an almost universal rule that the eyes are so much undeveloped as to produce total blindness. The fish taken in the Mammoth Caves of Kentucky are blind, and of a white colourless hue, as also is a species of Crawfish found in the same subterranean waters. The *Proteus anguinus*, inhabiting the caves of Illyria, exhibits the same peculiarities.

Through the kindness of my friend, the late Sir Emerson Tennent, I had on one occasion the opportunity of examining some newly discovered mud-fish found under the surface of the paddy-fields of Ceylon. The medium in which they exist is about the consistency of pea-soup; and their eyes are so small as to be almost imperceptible. It may be presumed, I think, that all these blind creatures obtain their food principally or wholly by scent.

But to return. The bones in the head of the Carp are very remarkable for their exquisite polish and symmetry, being as hard and as white as ivory, and resembling, indeed, a highly-finished marble sculpture more than anything else.[1] The arrangement of the bones forming the jaws and mouth is also very complete and beautiful. According to Blumenbach, Carp have the largest brain, in proportion to their size, of any fresh-water fish: they are certainly the most difficult to take by bait, and

[1] There is—or was before the migration to South Kensington—a skeleton of an enormous Carp in the British Museum, well worth inspection.

are credited on occasions with an inconvenient habit of cutting through the angler's line with the sharp spine of their dorsal fin. It also seems to be a well-established fact that when they see a net approaching they will bury their noses in the mud of the bottom and refuse to move, even though the leads of the net sweep heavily over them. By this means they escape. If, however, they should happen to be dragged up by the net, they will frequently endeavour, like the grey Mullet, to spring over the top: in short, there is no doubt that the Carp quite merits his sobriquet of the "water-fox."

The following method of Carp-fishing in stagnant waters, which I recommended in the "Angler-Naturalist," appears, so far as my experience goes, to be more successful than any other. "Let the line be entirely of fine, round gut—clouded if possible—with a very light quill float, and one or two small shot about a foot from the hook. Plumb the depth accurately; and arrange the distance between the float and the shot so that *the shot may exactly rest on the bottom*, weighing down the point of the float a little out of the horizontal, and letting the foot of gut below the shot and the bait lie on the ground. Fix the rod in the bank, and keep perfectly quiet. When a bite is perceived, do not strike, until the float begins to move away."

It constantly happens, however, that the Carp, especially if large and wary, will not be taken either by this or by any other mode of fishing.

I was once witness to a very curious occurrence, where a Carp—usually such a timid and dainty feeder—took in succession two hooks baited with worms, on two different lines, and was itself taken simultaneously by both, one hook being fastened on each side of its mouth. The distance between the two rods and baits at the time the fish took the latter was not less than several yards, and the floats disappeared almost at the same moment, both anglers striking together, and the Carp being lifted out between them. The boys to whom this singular accident happened were brothers, and I am sorry to add that, consanguinity notwithstanding, the dispute as to the ownership of the Carp waxed so warm as to render a final appeal to arms —or rather to fists—necessary.

Although, as observed, Carp are the most shy and difficult of capture of any of our fresh-water species, they are one of the easiest to tame. They feed readily in stews, and will come for their meals, according to some authors, at the ringing of a bell or at the sound of their keeper's voice. In the waters of some public gardens near Rotterdam, where the Carp attain to a great size, they are in the habit of following visitors about in expectation of food; and one immense fellow, with a side as broad as a flitch of bacon, and an appetite that seemed insatiable, actually pursued me for nearly a hundred yards along the side of the bank, until, my stock of bread being exhausted, I was fain to

try experiments with some paper pellets, when he sailed off in magnificent disgust. This fish must have weighed at least 15 lbs.

It is not to be supposed, however, from these instances, that Carp are the only fish which are capable of being tamed, or are sensible to the influence of external sounds. At Sir J. Bowyer's, near Uxbridge, Mr. Bradley tells us, there is, or was, a pond full of tame Pike, which could be called together at pleasure. Mr. Salter was acquainted with a person who for several years kept, in a water-butt, a Perch, which came to the surface for its food whenever his owner tapped on the side of the butt. According to Ælian, the Chad was lured to its destruction by the sound of castanets. Professor Rennie states, that in Germany, this fish is still taken by nets hung with rows of little bells arranged so as to chime in harmony; and, without going back to the story of Amphion and the Dolphins, or the old Scottish harper, who, according to the ballad, "harped a fish out o' the sa't water," we may find hundreds of well-authenticated anecdotes pointing to the conclusion that at any rate some species of fish have a very considerable perception of some sorts of external sounds.

Another peculiarity of the Carp is its power of sustaining life out of water—indeed, its "hard-dying" qualities must have come under the notice of most fishermen at some time or other. I have more than once taken a basket of Carp a consi-

derable journey in the broiling heat of a July or August day with no more moisture than could be obtained from a damp cloth, and yet they have been alive, and even lively, at the end of it. The idiosyncracy is so well known and acted upon that in Holland it is no uncommon practice to fatten Carp for the table by hanging them in a cellar in a net full of moss kept damp, and feeding them, like babies, on bread and milk poked into their mouths with a spoon.

The capacity of enduring this sort of amphibious existence is no doubt due to the construction of the fish's breathing apparatus, which is peculiar. The supports of the gill-leaves are bony; whilst in the Perch they are formed partly of bone and partly of cartilage, and in the Bream, Barbel, and Pike wholly of cartilage. The consequence is that instead of becoming stuck together when deprived of the moisture of the water, these gill-leaves, which represent the lungs of the fish, can be separated by the action of the muscles so as to absorb the oxygen from the air—in other words to breathe. In the Carp also the gill-openings, which in the Salmon and Trout are equal in extent to the length of the gill-arches, are partially closed by a membrane, thus enabling them to retain moisture.

I have seen it stated, though I cannot say that I have met with an instance within my own knowledge—that upon the drying up or exhaustion of a pond the Carp that were in it will bury themselves

deep down below the surface of the mud, and reappear like the mud-fish of the East in undiminished numbers upon the first return of water.

During the winter months it is probable that Carp retire almost wholly into the mud, or under roots, hollows, and weeds, and at this time they are hardly ever to be taken with a bait. In the summer they frequently lie sucking in the weeds, in a sort of lazy state, each suck making a very distinct and unmistakable noise. It much resembles the sound made by a pig,—to which animal, indeed, a big Carp has always appeared to me to bear a striking likeness both in face and character. When not sucking or basking, the Carp usually swims about in shoals near the surface of the water, returning to the bottom to feed. Early in the morning and late in the evening are the best times for Carp fishing.

Carp spawn toward the end of May or beginning of June, according to the temperature of the water and the season; they are supposed to continue spawning occasionally for four or five months, and always for a longer period than most other fish. The ova—which in a specimen weighing 9 lbs., were found by Block to number 600,000—are deposited upon weeds, amongst which the female is followed by two or three males, thus securing the impregnation of a large proportion of the eggs.

Characteristics common to all the Carp Family.—Fin-rays almost entirely flexible. Ventral fins suspended to the abdo-

men behind the pectorals, without being attached to the bones of the shoulder. Mouth shallow; lips commonly fleshy; jaws feeble, generally without teeth. Powerful teeth in the throat. Only one back-fin. Body scaly. Very few gill-rays.

Besides the Common Carp, and *cyprinus auratus* (the ordinary gold and silver fish of the aquaria,) there is another—though far from common—species belonging to the genus of the true Carps, called the Prussian or Gibel Carp (*cyprinus gibelio*), a much rarer fish than the common Carp, and probably by anglers very often confounded with it.

From the common Carp, however, it is entirely distinct, the following being the most obvious structural differences :—The whole general appearance of the fish is much more thick and chublike than the common Carp, resembling in fact the Rudd in external form more than any other fish,—the common Carp much more nearly approaching that of the Barbel.

In the common Carp the length of the head is almost invariably *greater* than the depth of the body in the deepest part, whilst in the Prussian Carp it is always very much less.

The scales on the Prussian Carp are larger, the number in the lateral line being about 33—and in common Carp about 38.

The mark, however, by which the angler may always at once distinguish the two fish on the most cursory examination is the mouth. This in the common Carp has two little barbels or beards

at each corner, whilst in the mouth of the Prussian Carp no beards whatever exist.

There are a good many other minor points of difference which will be observed on a careful comparison of the fish, but the above marks are easily verified, and are amply sufficient for all purposes of distinction.

Some ichthyologists, including Yarrell, make a third species of British Carp, which they name the Crucian Carp (*cyprinus carassius*); but as this distinction is founded on one or two specimens only, said to have been caught in the Thames, I am of opinion that there is not sufficient ground for the distinction, which adds a needless complication in the way of the fisherman and student of ichthyology.

The Prussian Carp usually spawns about April or May, or occasionally later, and in habits, food, &c., has many points in common with the ordinary Carp, from which it differs, however, in that it rarely exceeds a couple of pounds in weight.

The Prussian Carp is found in several counties of England, and probably exists in many others where it has not hitherto been noticed. It is particularly common in the neighbourhood of the Thames. It seldom bites freely, and consequently but little success attends the angler. In habits and food the Prussian Carp closely resembles the preceding species; and it is so tenacious of life, that it

has been known to survive after having been kept out of the water thirty hours.

The principal characteristics of a Prussian Carp that I examined were :—

The total length of the fish, head, body and tail fin inclusive being as 4, the length of the head alone is as 1. Depth of body at deepest part 1-5th more than length of head: back fin very long; tail fin forked but not quite so much so as in the common Carp. Mouth small, toothless: back and belly line both convex. Colour: sides and cheeks pale straw colour, rather more silvery than golden—ventral and pectoral fins a light pinkish tint. Tail and dorsal fins the same, only greener. Irides silvery and green.

I did not count the fin-rays which, however, Yarrell gives as,

Fin-rays: D. 4 | 16: P. 14: V. 9: A. 3 | 6: C. 19.

THE TENCH.[1]

ALTHOUGH not of the same genus, yet belonging notably to the same family, the Tench follows the Carp with the same sort of propriety as that which almost invariably links together the names of the Salmon and Trout in our fishing books and manuals of ichthyology. The fish are constantly found in the same localities—indeed, I scarcely know a pond containing the Tench which does not also contain one or other variety of the Carp,—they are both equally long-lived out of water, their habits and food are the same—the modes of fishing for them are the same, and the bait most successfully used for catching the one will very frequently bring the other floundering up out of the mud.

And yet, strange to say, in not a few points it would be difficult to find two fish more dissimilar. The Carp, for instance, has the largest scaling of any of the fish composing the group of which it is the type, whilst the scales of the Tench are

[1] *Tinca Vulgaris.* *Tinca*, the Tench, *vulgaris*, common, Lat.

amongst the smallest, if not actually the most minute of the whole family; the general hue of the Carp is golden and bronze, that of the Tench deep olive green; and whilst the former makes one of the very best Pike-baits I am acquainted with, the latter, it is affirmed, exerts upon that usually omnivorous gourmand an effect absolutely repellent. Of the truth of this, as a fact, there seems to be no reason to doubt, though we are not, of course, bound to put implicit faith in the various theories by which it has at different times been explained. Of these the most universally accepted amongst ancient, and even by some modern authors appears to be that the Tench is in some way the physician of the water, possessing in the thick slime with which he is covered, a natural balsam for the cure of himself and others. Rondeletius even says that he saw a great recovery effected upon a sick man by the application of a Tench to his feet.

Without, however, trenching so nearly on the domain of the miraculous, there certainly are many accounts on record of the restoration of sick and wounded *fish* by contact with the Tench. The following, mentioned by Mr. Wright, in his book on "Fishes and Fishing," is one out of a hundred of such alleged instances that might be quoted :—

"A gentleman, who was unfortunately unable to leave the house for some time through an accident,

amused himself by making small artificial flies, which he did very neatly. He kept some minnows, and a Tench about $2\frac{1}{4}$ inches long, in a very large wide-mouthed bottle; all the minnows had died except one; my friend was just finishing a fly as I went into his room, and he held it upon the surface of the water in the bottle as he was often in the habit of doing; the minnow darted at it so rapidly, that he could not withdraw the fly in time to prevent the hook from pricking the minnow; the little fish descended three-parts of the way down the bottle, poised himself for a moment, with his nose pointing downwards, then swiftly went the remainder of the way, rubbed his nose during a few seconds against the side of the Tench, and again swam about as lively as before. We both joined in the opinion that it is really no fable as to the Tench being the Æsculapius of fish; for here was an example before our eyes of a fish being wounded, and immediately instinct directing him to seek a remedy."

Camden in his "Britannica," also alludes to this circumstance. "I have seen," he says, "the bellies of Pikes which have been rent open, have their gaping wounds presently closed by the touch of the Tench, and by his glutinous slime perfectly healed up."

In fact for the Tench has been literally claimed the royal gift of healing by touch.

Equally numerous, if not perhaps more credible, are the testimonies to the fact that the Pike, destructive and insatiable to all else, has yet that "grace of courtesy" left in him that he spares to molest his physician, even when most pressed by hunger; perhaps upon the same principle as that which guides his prototype, the shark, in sparing the useful and friendly little pilot fish. Amongst other angling authorities, Oppian, Walton, Hollinshed, Bowlker, Salter, Williamson, Hofland, and Fitzgibbon, all acknowledge to more or less faith in the truth of the assertion. Salter says, "I have known several trimmers to be laid at night, baited with live fish, Roach, Dace, Bleak, and Tench, each about 6 or seven inches long; and when those trimmers were examined in the morning, both eels and Jack have been taken by hooks baited with any other fish than Tench, which I found as lively as when put into the water the preceding night, without ever having been disturbed. This has invariably been the case during my experience; neither have I met with one solitary instance to the contrary related by any of my acquaintance, who have had numerous opportunities of noticing the singular circumstance of the perfect freedom from death or wounds which the Tench enjoys over every other inhabitant of the liquid element, arising from continual conflicts with each other."

I have quoted some portion of the preceding from the "Angler-Naturalist," in which I also

mentioned that to try the experiment practically, I procured some small Tench, and fished with them as live-baits for a whole day in some excellent Pike water, but without getting a touch. In the evening I put on a small Carp, and had a run almost immediately. I also tried some Pike in a stock-pond with the same Tench, but they would not take them; and though left in the pond all night—one on a hook, and one attached to a fine thread—both baits were alive in the morning,—some Pike-teeth marks, however, being visible upon the hooked fish.

These are *facts* which (having occurred within my own knowledge) I can mention with certainty, but at the same time without expressing any opinion as to the truth or otherwise of the theories by which the curious in ichthyology would propose to explain them. The whole question would form a very interesting and legitimate subject for experiment to any one who might have leisure and inclination to investigate it practically.

The notion of the Tench being the Pike's physician has been thus admirably versified:—

> "The Pike, fell tyrant of the liquid plain,
> With ravenous waste devours his fellow train:
> Yet howsoe'er by ragi[n]g famine pined,
> The Tench he spares—a m[e]dicinal kind;
> For when, by wounds distrest a[n]d di[s]ease,
> He courts the salutary fish for ease
> Close to his scales the kind physician glides,
> And sweats a healing balsam from his sides."

A less poetical explanation of the Pike's abstinence is given by Bingley, who suggests that, as the Tench is so fond of mud as to be constantly at the bottom of the water, where the Pike cannot find him, the self-denial of the latter may be attributable to less elevated causes. This prosaic theory, however, also requires confirmation,

As to the gastronomic qualities of the Tench opinions differ, but in Holland and some other parts of Europe it is a common dish at the dinner-table and is thought both wholesome and nutritious. Like the Eel, however, it would appear to be palatable in a precisely inverse ratio to the cleanliness of its abode, improving in gustatory attractions as it approaches more nearly in colour and diet the composition of its habitual mud. Thus, "Tench were taken out of Munden Hall Fleet, Essex, which was so thick with weeds that flue nets could hardly be sunk through them, where the mud was intolerably fetid and had dyed the fish of its own hue, which was that of ink; yet no Tench could be better grown or of a sweeter flavour." . . . "In a clean pond at [illegible] Priory a quantity of Tench were caught, [illegible] lbs. weight each, of a colour the most gol[illegible]nd beautiful; but when dressed and bro[illegible] table [illegible]melt and tasted so rank[illegible] them!" The re-mo[illegible] the fish with warm water before cooking is said to take away the muddy taste.

The best bait for the Tench is a well-scoured brandling—the method of fishing being similar to that adopted for Carp. Mr. R. B. Marston, in a capital article on Tench-fishing, published in the "Fishing Gazette" of 24th Oct., 1885, recommends a second hook baited with brown-bread paste, and placed about four inches above the hook that is baited with the worm, so that one lies on the bottom and the other just floats clear of it.

The specimen from which the illustration was taken was a female fish weighing about 2 lbs., and in very fine condition. Between the male and female Tench a marked and curious difference exists in regard to the ventral fins. In the females these fins are of the ordinary size and shape, but in the males they are much larger and more muscular, and present almost the appearance of a green concave shell, the concave side being uppermost. From five to six pounds is about the usual maximum weight, the largest recorded to have been taken—a fish fifty years old at least—weighing somewhat over eleven.

The Tench spawns with some variations about the middle of June, or, according to Willoughby, when wheat is in blossom.

The following were the principal measurements, &c., of the fish represented in the engraving:—

The length of the head alone being considered as 1, the total length of the head, body and tail-fin not quite as 5. Depth of body at deepest part 1-5th more than length of head. All

the fins rounded at the extremities. Tail-fin not at all forked, nearly square with the corners rounded off; mouth small, toothless; with one barbed at each corner. Scales very small. Colours: head, sides, and cheeks golden green; darker on the back and fins; orange yellow under the belly; irides bright orange red.

THE BARBEL.[1]

THE Barbel is distinguished from the last genus (*Cyprinus*) in having the back- and anal-fins short instead of elongated, with a strong bony ray in the dorsal fin,—the mouth also being furnished with four barbels or "beards." Exclusively a river-fish, it is a native of many parts of England, and abounds particularly in the Trent and the Thames; in the latter being so numerous, that in the neighbourhood of Weybridge as much as 280 lbs. weight have been taken, according to local tradition, by a single rod in one day. At Temple Weir, near Marlow, I have also known some extraordinary baskets to be made.

Although, in an angling point of view, less wary and difficult of capture than the Carp, the Barbel, both in its natural state and in confinement, is the shyest and most untameable of all our freshwater fish, except perhaps the Loach, exhibiting an ex-

[1] *Barbus vulgaris.* "Bearded," from *barba*, a beard, Lat.; *vulgaris*, common, Lat.

THE BARBEL. (*Barbus vulgaris*)

Vincent Brooks Day & Son. Lith

To face page 116.

traordinary degree of reserve and intolerance of observation. In the spring, however, when the fish seek the gravelly shallows to spawn, they become very lively, and at this season may sometimes be seen tumbling and rolling about with their bodies half out of the water like a shoal of porpoises. Amongst some specimens kept in a vivarium, it was observed that, when they fancied no one was looking, they would plunge and rub themselves against the brickwork and otherwise show considerable signs of playfulness.

The name "Barbel," as already noticed, is derived from the barbs or beards at the corners of the mouth. These are evidently designed to assist the fish in feeling its way about in deep and, consequently, more or less dark waters, which are its natural habitats, and probably also for the purpose of enabling it to detect the nature of the substances with which it comes in contact. Of the species provided with these barbs or beards—viz., the Carp, Tench, Gudgeon, Loach, and Burbot—all find their food principally, or wholly, on the bottom; and generally the fact of a fish being "bearded" affords a correct index to its habits.

The Barbel is not much of a fish-eater, although it has been known occasionally to take small fry such as Minnows. Its ordinary food consists principally of worms, slugs, grubs, &c.; and in order to procure these it routs about amongst the gravel with its nose, in very much the same manner that

a pig furrows a field with its snout. Lob-worms, gentles, and greaves (here placed in what may probably be regarded as their order of merit), are the usual baits for this fish. Three styles of fishing also, one of which is peculiar to the Barbel, are commonly employed for its capture, viz., ordinary float-fishing, Nottingham-fishing, and "legering"—the last the specialty of the art, and until late years almost wholly confined to the Thames and its *habitués*.

The Barbel spawns in May or June, depositing its ova, which in a large fish sometimes number 7,000 or 8,000, in the gravelly or shingly beds of the stream, where they are immediately covered by the parent fishes. These eggs are vivified, in warm weather, between the ninth and fifteenth day.

The spawners, so soon as they have recovered a little strength, make their way into the swiftest streams they can find, such as weirs, mill-tails, &c., to scour and brace themselves, beginning to get into condition again in a few weeks, and being in the best season for the angler until September and October, when the frosty nights drive them from the streams and shallows into the deeper waters. Here they will be found until the spring; and in these quiet deeps and eddies they are to be caught, if anywhere, during the winter months. At this period, however, especially if the weather is very cold, it is of comparatively little use to fish for them, as they lie in a sort of semi-torpid condition and refuse to move. So inanimate are they, that

the fishermen, it is said, not unfrequently provide themselves with hoop landing-nets which they place near the Barbel and with a pole literally push them in. Shoals sometimes collect under the shelter of a sunken punt or other tidal obstruction, lying one over the other as closely as they can pack, and when thus congregated are often taken by being "hooked foul." I have also been assured that boys and others who are good swimmers will dive into the water and take them with the hand from under the banks and holes.

Barbel are numerous in many parts of the world; but their natural habitat appears to be the warmer climates of Europe, and it is stated by Cuvier that in localities favourable to them they will grow to 10 feet long. They are plentiful in the Danube, the Rhine, the Elbe, and the Weser, in almost all the rivers flowing into the Black Sea, and in the Volga, where they attain the weight of 40 and 50 lbs. In this country the usual weight does not exceed 10 lbs.; but specimens have been occasionally taken as large as 15 lbs., and one is even chronicled as having been caught in the River Lea which weighed 19 lbs. Such a leviathan must have taxed both the patience and the muscles of his captor—if, indeed, he was taken by rod and line—as the Barbel is exceedingly strong and makes a powerful fight, showing as much sport, though in a dogged sullen sort of way, as almost any fish of the same size except perhaps

the Salmon-Trout. It is, however, in small esteem for the table, at which in this country it seldom makes its appearance though frequently figuring in French and German *menus*. Indeed, I remember an English country-house on the banks of the Thames where a dish of Barbel was a not uncommon and much appreciated addition to the breakfast-table. The fish was baked in a large open pie-dish, with plenty of cloves and spices—whether with or without vinegar or other sauce or gravy I am not sure—but the jelly it formed when cold was as firm as that of strong soup.

It has been observed that many species of the Carp family have the power of emitting a guttural sound under water, although the mechanism by which this is effected is not understood—no air-bubble escaping from the mouth of the fish at the time—and amongst the species producing these sounds the Barbel is particularly noted.

Besides those already mentioned, the principal characteristics of the Barbel are—Mouth toothless; throat-teeth in three rows on each side, the rows numbering 2, 3, and 5 respectively. Body elongated. Length of head compared with total length of fish as 1 to 5; depth of body less than length of head. Head elongated, wedge-shaped; upper half of jaw much the longer. Upper lip circular and fleshy. One pair of barbels at the front of the nose, and a single one at the end of upper lip on each side. Third ray of back-fin largest and strongest, toothed on its hinder surface. Tail deeply forked at the end. Colour (taken from a Thames fish weighing about 6 lbs., caught Sept., 1885, by Percy Mitchell, Esq.): back, and back-fin olive brown, with a bronzy tone; head the same; *irides* and

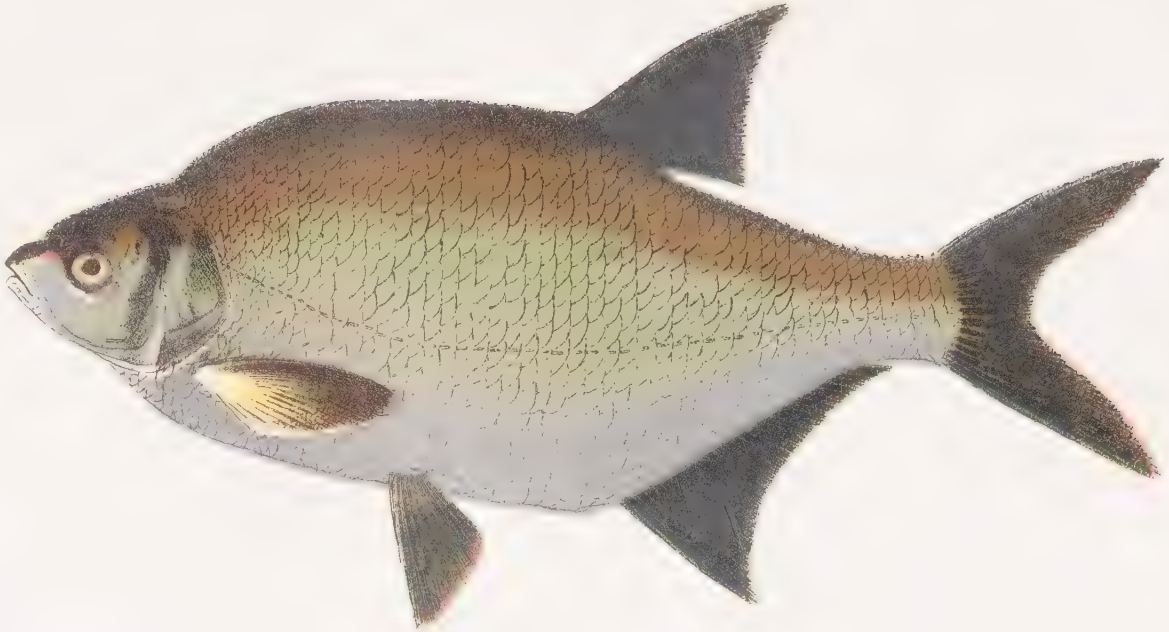
gill-covers just behind the eyes golden bronze; upper part of body, general effect greenish brown, becoming yellowish or bronzy green on sides; belly and throat silver white; scales at base browny bronze, at margins silvery whitish; barbels at corners of mouth, pale fleshy pink; margins of all the fins (except the back-fin), and including tail-fin, pale fleshy pink, which extends—diminishing in intensity—nearly to the bases or origins of the several fins.

THE COMMON OR CARP BREAM.[1]

WE pass now to the Breams, which are distinguished from the thick-skinned Carps by their bright nacry scales. Unlike the latter fish and the Barbel, the Breams have no strong bony rays in the fins, nor any beards at the corners of the mouth. The body in all the species is deep and thin, or compressed, the outlines above and below being very convex: the base of the back-fin is short, and placed further back than the ventral fin, whilst the base of the anal fin is very long.

If we may credit the French proverb quoted by Izaak Walton, that "He that hath Breams in his pond is able to bid his friend welcome," these fish would seem to be in considerable request on the Continent as an edible. In England they are seldom considered worth cooking, and the variety known as the White Bream, or Bream-Flat, enjoys a thoroughly evil reputation. Few fish, however,

[1] *Abramis brama. Abramis*, a Bream, Gr.; *brama*, the Bream, Lat.



THE COMMON BREAM *(Abramis brama)*

To face page 122

afford better sport with the rod and line than the Carp Bream, as they are exceedingly strong and vigorous, sometimes weighing as much as 7 and 8 lbs.—according to the author of the "Angler's Instructor" even 17 lbs.—and are by no means shy biters. Bream form also a useful stock for ponds, or to feed Pike, being hardy and of quick growth. The ova in one female have been counted, and found to be 130,000.

There are two species of Breams commonly found in this country—the Carp-Bream and the White Bream or Bream-Flat. The Carp-Bream is in its distribution an inhabitant of all the central districts of Europe, as well as those northward to St. Petersburg, Finland, and Scandinavia. Some of the lakes of Ireland also produce it in large quantities. In England it is found in many counties, appearing to thrive best in large open sheets of water and in slow rivers where the stream occasionally widens out into broads or deeps as in Norfolk. Of the rivers near the metropolis which breed this fish perhaps the Mole and the Medway are the most noted. Bream are also very numerous in the Thames at Weybridge just below its junction with the Wey, and in the latter river higher up towards Wisley are occasionally caught of very large size. I once examined a specimen weighing upwards of 5 lbs. taken thence; the scales of this fish were rough and almost file-like, from a small whitish tubercle which is a periodical produc-

tion common to the species, as well as to several others of the Carp family, at the spawning-time.

The smaller and inferior variety of this genus, already mentioned, called the White Bream or Bream-Flat (*Abramis blicca*), is frequently found in the same waters as the Carp-Bream, and in habits and food is nearly identical. The principal points in which it differs in appearance from the Carp-Bream are—(1) its colour, the prevailing tone of which is rather silvery than yellow; (2) its size—the Bream-Flat rarely exceeding 1 lb. in weight; and (3) its teeth (throat-teeth), which are in two rows on each side, numbering two and five respectively,—those of the Carp-Bream being placed in only one row on each side, numbering five. This last point of difference is so obvious and easily verified that no mistake can possibly occur. Other minor distinctions will be observed on a close comparison of the fish. The White Bream is known to exist in Cambridgeshire, Nottinghamshire, Norfolk, and Dumfriesshire. I have taken it frequently in the River Wey in Surrey, and it is probably locally recognized in many other counties. It is also common on the Continent and in Scandinavia. It is best fished for with roach-tackle and a red worm or gentle, and has this singular habit—by which it may be constantly recognized, even before it has been seen—of rising instead of descending with the bait; in consequence of which the float, in lieu of being drawn under water, is laid flat upon

the surface. The fish takes a bait readily, but often spits it out again from being too indolent to swallow it. The Swedish fishermen call it the *Actare*, or the Glutton.

In the Bavarian dialect the term *blicke* is applied to fishes that have a silvery glitter in the water whence the specific name *blicca*, given to it on account of the brightness of its colour as compared with the Carp-Bream.

The principal characteristics of the White Bream are—

Throat-teeth hooked, in two rows as above stated. Length of head compared with that of body alone as 1 to 3. Head larger, and fleshy portion of tail comparatively deeper, than in the Carp-bream. Scales larger than those of the latter. Lateral line not quite so low down, and with fewer scales, numbering 46 or 50. Relative position of fins very similar; fin-rays different in number. Colour, generally, of the sides bluish white, without any of the golden-yellow lustre observable in the Carp-Bream. Ventral and pectoral fins tinged with red.

Fin-rays: D. 10: P. 14: V. 9: A. 23: C. 19.

The Pomeranian Bream[1] is another variety—so scarce as to be rarely recognized, even when accidentally met with. It may be readily distinguished, however, both from the White and Carp-Bream by the number of throat-teeth on each side, which are in two rows numbering five and three respectively, instead of, as in the former, in two rows of five and two, and, as in the latter, in a single row of five. It is also distinguished by the greater thick-

[1] *Abramis Buggenhagii.*

ness of its body, which is equal to half its depth, whilst in the other two the same measurement is only equal to one-third of the depth. The anal fin is shorter and has a smaller number of rays than that of the Bream-flat, which, again, presents a similar proportion as contrasted with the Carp-Bream. It is a very rare fish, being only known to inhabit a few waters, amongst which may be mentioned the River Lagan near Belfast, a pond at Bottisham in Cambridgeshire, some water near Wolverhampton, a few of the Broads of Norfolk, and the preserves at Dagenham Reach, Essex, well known to London anglers.

Length of head compared to total length of body as 1 to 5; depth at deepest part as 1 to 3. Head small and pointed. Mouth small, toothless. Throat-teeth in two rows (numbering five and three respectively) on each side. Number of scales in lateral line 52. Vertebræ 41. Colour: over upper part of head and back dark blackish blue, becoming lighter on the upper part of sides; lower part of sides and belly silvery white; fins bluish brown, more or less tinged with brown.

Fin-rays: D. 12: P. 17: V. 19: A. 19: C. 19.

Of Carp-Bream large "takes" are occasionally made by rod and line in the Weybridge Deep before referred to, the method of angling found most successful being the Nottingham system of float-fishing alluded to under the notice of the Barbel, the baits and ground-baits for which are also those most killing in Bream-fishing. Bream are gregarious, and their food consists of worms.

slugs, aquatic insects, and vegetable substances: they spawn in May.

The specimen, a fine male, selected for representation was taken by Mr. James Smithers, in the Wey near Byfleet. Its colours were: belly white; sides, nearly up to the top of the back, silvery gold with a slight greenish tinge above the lateral line; all the fins greenish black, pectoral and ventral fins rather lighter; irides silvery, with a narrow bright yellow circle round the pupils; upper outline of fish almost black when held up to the light and looked at sideways; lateral line very concave; tail exceedingly forked, anal fin very long.

Other Characteristics of the common Bream.—Throat-teeth cylindrical, with smooth crowns adapted for bruising, placed in single rows, five teeth on each side. Mouth small, toothless, without barbels. Scales placed in curves on the fore part of the back, a naked place behind the ventrals. Length of head to body as 1 to 3. Head small, nape of neck depressed. Body deep and flat, very convex above and below, scales comparatively small. Scales of lateral line varying in number from 52 to 58.

Fin-rays: D. 11: P. 17: V. 9: A. 29: C. 19.

THE ROACH.[1]

THE Roach—or, as its technical name might be translated, the "Red Dace," from the scarlet colour of the fins—is a great favourite with London fishers, who at any time between August and May may be seen perched, regardless of safety, upon projecting trees, bridge-buttresses, and, indeed, every other accessible "coigne of vantage" between Battersea Fields and Walton on Thames, or clustering on the hundred-and-one lock-gates with which the pretty river Lea is intersected almost to its source. From these perilous eminences they contemplate—and we may presume are also contemplated by—the intelligent *Leuciscini*, which, notwithstanding, seldom fail to find their way in greater or less numbers into the cockney's basket. The Londoners, in fact, bear away the palm from all competitors in Roach-fishing—a department of angling, be it said, demanding a by no means small amount of quickness of hand and eye. Mr.

[1] *Leuciscus rutilus.* *Leuciscus*, a Dace, Gr.; *rutilus*, red, Lat.

THE ROACH *(Leuciscus Rutilus)*

To face page 128.

Jesse, who has amusingly classified the several orders and *genera* of Thames anglers, gives the Roach and Dace fishers a very high rank for skill and patience, and believes that they very seldom attempt, or understand, any other branch of the gentle craft; whilst my friend Mr. Senior elevates them still further in the angler's "precedence," by devoting to their pursuits a charming article entitled "Roach Fishing as a Fine Art."[1]

The largest shoals of Roach appear in the Thames about the middle of May or early in June, when they ascend from the lower parts of the river to deposit their spawn in the higher reaches, fighting their way up the strong rapids with persistent energy, until they find a suitable spot. This migration, it has been thought by some authors, takes place from the sea; but the opinion seems to be erroneous as all experiments have tended to prove that the roach will not live in salt water. A similar annual exodus has been noticed in Loch Lomond and elsewhere. The Roach deposit their spawn on the surface of weeds in shallow water, and whilst in the act of spawning may sometimes be seen by hundreds together with their back-fins out of water: a very few days suffice to complete the reproductive process and the fish then seek swift gravelly shallows on which to scour themselves. These they soon quit, how-

[1] "Badminton Library of Sport:" Longmans & Co.

ever, for quieter currents, where they remain several months, retiring about October into the deeps and still waters for the winter, and always selecting a gravelly or sandy bottom in preference to a muddy one.

In the nature of its food the Roach resembles the Dace, feeding, however, principally at night, and by day swimmimg about in large shoals near the bottom. The best general bait is the gentle; but pastes of various kinds, and sometimes small red worms, are found equally killing.

Roach will not unfrequently take the artificial fly, especially when first scouring themselves after spawning, and I have caught some very fine specimens with the gentle, thrown like the fly, and also when dapping for Chub with the imitation grasshopper. A ludicrous incident in connection with the fly-catching propensities of the Roach is mentioned in a recent work on Angling:—A gentleman passing by the Round Pond on Clapham Common, observed these fish rising freely at the swarms of hovering *ephemeræ;* and wishing to try whether they would not be equally susceptible to the artificial insect, sent back for a fly-rod, &c., and a small fly. The Roach, however, in this instance refused to be enticed; but a fine Newfoundland dog which was swimming about, snapping impotently at the gnats and midges, perceived the apparently drowning insect, and dashed at it —"taking the death" with a plunge like a heavy

Salmon, and being fairly hooked in the jaws. Away went the astonished dog towards the opposite shore—away went the line—and away went the equally astonished angler himself, who, anxious to save his tackle, and being withal of somewhat pursy and plethoric habit, was obliged to make desperate efforts to keep up with his novel *détenu*. Finding himself thus chased by what must have appeared to him to be a man brandishing a huge whip, the dog made for home as fast as his legs could carry him, followed by the shouts of the spectators, and also by his unwilling captor, who, despite his obesity, gallantly maintained the race, springing over "bank, bush, and scaur," and steering his prisoner safely through opposing furze-brakes, until he landed him at his master's domicile.

It once happened to me to hook a half-grown wild duck, or "flapper," in a somewhat similar manner in Loch Lochy, except that in this instance the cast, which was made with a spinning bait, was intentional. The duck, "hooked-foul" as it was in the act of diving, continued submerged until netted at the side of the boat. The author of the "Angler's Rambles" mentions an anecdote of a hare being thus taken with a trout-fly as she was attempting to swim a river. The fly, adroitly cast, stuck into the fur of her back, and, as her captor remarked, landed her "*comfortably*."

Curious instances are related of birds and other animals accidently swallowing fish-hooks. Within

my knowledge both waterhens and cats have been caught in this manner. Ducks are the constant victims of their incautious rapacity, and barn-door fowls have not unfrequently been tempted to destruction by the allurements of a baited minnow or seductive "green drake." An instance of the latter is mentioned by Mr. Wright :—A gentleman fishing with May-flies in the river Wye went into an inn on the road-side, leaving his rod in the portico, where a fine white cock took a fancy to the fly, and became hooked in the soft part of the beak. Feeling the hook the intruder prepared to beat a hasty retreat and in so doing pulled down the rod, with which he was running away in great alarm; but the angler, hearing the noise, sallied forth, gave chase, and regained his departing paraphernalia, when the cock mounted into the air, and was with some difficulty brought down and secured.

The Roach spawns about the end of May or the beginning of June, when the scales become rough to the touch. The largest specimen that I am aware of having been taken is that mentioned by Pennant, which weighed 5 lbs.

There is another species of the *genus leuciscus*, closely allied to the Roach—so closely, indeed, that it has by some authors been supposed to be a hybrid between that fish and the Bream or Carp—viz., the Rudd or Red-Eye, *leuciscus erythroph-*

RED EYE. (*leuciscus erythrophthalmus*

To face page 132

thalmus. It is a pond rather than a river fish, thriving best in broad shallow meres and lagoons, like Slapton Ley, in North Devon, and several of the "Broads," as they are called, of Norfolk. Under such favourable conditions Rudd multiply in an extraordinary manner, feeding perhaps principally on some species of water-weed with which, at Slapton Ley, I have constantly found their stomachs to be filled. In this latter sheet of water they grow to an occasional weight of over 3 lbs.—specimens from 1 to 2 lbs. being very common. When of this growth the Rudd affords capital sport as they will readily take a gentle thrown in the same way as an artificial fly, and sometimes —though here I speak from report and not from my own observation—the artificial fly itself.

When first caught, and in full season, I should unhesitatingly give to the full-grown Rudd the palm for brilliancy of colouring, if not for general appearance, over all other "coarse" fresh-water fish of the British Islands. The general hue of the body is a reddish gold, varying according to the light in which it is seen; the eyes and fins are tinted different shades of crimson, orange, and green, whilst the cheeks and sides are of a rich golden yellow. From this colouring it is needless to say it derives its English name—"Rudd." The specific name, *erythrophthalmus* (from the Greek, *erythros*, red, and *ophthalmus*, the eye), has also a similar origin.

Some authors have imagined that this fish is a hybrid between the Bream and the Roach, an opinion which Walton also seems to have shared. "There is," he says, "a kind of bastard small Roach, that breeds in ponds, with a very forked tail, and of a very small size, which some say is bred by the Bream and right Roach; and some ponds are stored with these beyond belief; and knowing men that know their difference call them Rud: they differ from the true Roach as much as does a herring from a pilchard. And these bastard Roach are now scattered in many rivers, but, I think, not in the Thames." Elsewhere he adds, "Some say that Breams and Roaches mix their eggs and milt together; and so there is in many places a bastard breed of Breams that never come to be very large or good, but that are very numerous."

The species referred to by Walton are, no doubt, the true Rudd and the White Bream, or Bream-flat,—the more common size of the former being, as he describes, exceedingly small, and the latter seldom exceeding a pound in weight. The researches of modern ichthyologists have, however, thrown great doubts upon the existence of any constantly recurring hybrids amongst fish, and there can be no doubt that in the instances referred to the three species are distinct. Without going into the general question or giving all the reasons on which this conclusion is based, it may be men-

tioned that the Rudd is constantly found in waters in which no Bream exist, and that the Bream-flat has been recognized only in a comparatively few rivers, whilst in hundreds Roach and Bream co-exist plentifully together, without either Rudd or Bream-flats.

The Rudd is the "Shallow" of Cambridgeshire, the "Roud" of Norfolk, and the "Roach" (that is the fish commonly so-called) of Ireland.

It spawns in April or early in May, breeding, as I have observed, very freely in water the conditions of which are suitable, and owing to its being remarkably prolific making a capital stock for the feeding of Pike and Perch. As a live-bait for the former it is particularly worth notice, its glittering tints and the scarlet colour of its fins giving it a bright and highly attractive appearance in the water. It is also remarkably tenacious of life. In its habits and general mode of feeding the Rudd resembles its congener, the Roach. The most remarkable differences between the two species (I write with the fish before me) are as follows:—

In two specimens of the same length: The body of the Rudd is a good deal flatter and deeper than that of the Roach; and the head is much shorter and more "chubby," being in fact little more than $\frac{3}{5}$ths of the length of that of the Roach. The dorsal-fin of the Roach commences as nearly as possible over the ventral fins, whilst in the Rudd it is placed considerably further back. In

colour the general appearance of the Rudd is golden, and that of the Roach silvery.

The most obvious mark, however, and that by which the Rudd can be both easily and certainly distinguished from the Roach, is the relative position of the back fin—above described—as this never varies and can be seen at a glance; indeed, so marked is it that upon this structural difference ichthyologists have placed the two fish in different sections of the same genus.

Although the external form of the Rudd is perhaps almost as much like that of the Bream as of the Roach, there is, in consequence of its scarlet fins and generally "Roach-like" appearance, no other fish with which it can well be confused, even by the least initiated, and it is, therefore, unnecessary to enter into a comparison of its characteristics with those of any other species.

The full measurements and colouring of the two fish are as follows:—

The Rudd.—Length of head not *quite* $\frac{1}{6}$th of total length (including head, body, and tail-fin to the extremity),—shape of head "chubby." Depth of body at broadest part not quite equal to twice the length of the head. Dorsal-fin commencing a good deal further back than the ventrals (about as much further back as $\frac{3}{4}$ths of the length of the head). Base of dorsal-fin, midway between point of nose and extremity of tail-fin. Scales large, number in lateral line about 42. Number of scales in oblique line at widest part of body, 12. Teeth pharyngeal. Colours: back and head olive green, then bronze, merging into silvery-golden on the sides, and becoming

silver-white on the throat and belly; gill-covers, bright orange behind the eyes. The whole of the irides red-orange. Pectoral and dorsal fins pinky-olive, or olive, slightly tinged with red towards the extremities; ventral- and anal-fins, bright crimson; tail-fin, with a base of olive-green tinged with crimson, the crimson getting more vivid towards margin, and top and bottom fin-ray. The whole appearance of the fish golden as distinguished from the silvery appearance of the Roach. [The specimen from which the above colouring was taken was a Slapton Ley fish weighing about 1½ lbs., caught by W. G. F. Whittingstall, Esq., October, 1885.]

The Roach.—Length of head, ⅕th of total length (including head, body, and tail-fin to the extremity). Muzzle rather sharp. Nape of neck rising abruptly. Depth of body at broadest part only equal to ¼ more than the length of the head, and equal to ¼ of the entire length of the fish, head and tail-fin included. Dorsal-fin commencing exactly over commencement of pectoral-fin; 1st ray midway between point of nose and end of fleshy part of tail. Scales in lateral line, 43; in oblique line at widest part of body, 12. Teeth pharyngeal (in the throat). Colours: back, dull olive, or brownish-green; cheeks and sides silvery, with a patch of orange on each cheek and just over the eye; belly, white; *irides*, orange-red. Ventral- and anal-fins bright crimson, ventrals brightest. Pectoral-fins paler crimson, mixed with a little orange and green; back-fin and tail-fin darker tint of crimson, mixed with a good deal of green. [This is the full colouring of a Thames Roach of about ½ lbs. weight, taken at the end of October or beginning of November last at Marlow. A slight tinge of gold, perceptible all over the head and gill-covers, increases as the fish gets older, the sides also become less silvery.]

THE DACE[1] AND THE CHUB.[2]

THE Dace, *leuciscus vulgaris*, or common Dace, is the typical fish of the *genus leuciscus*, which contains in addition the Chub, the Roach, the Rudd, the Bleak, the Minnow, and the Graining, the last-named fish being so exceedingly rare as to possess little interest, except from the naturalist's point of view. The Dace on the contrary is constantly met with and from its game qualities when hooked is well worthy of the fisherman's notice. It is a bright graceful fish, glancing about in the clear quiet streams with which the southern counties of England especially abound, and which are often barren of Trout or Salmon. Moreover it is in full season in October, November, December, and January, when the Trout are spawning or preparing for the process, and thus a red-letter day's sport is often to be obtained, which would otherwise have had

[1] *Leuciscus vulgaris*. *Leuciscus*, Gr. for Dace; the diminutive of *leukos*, white; *vulgaris*, common, Lat.

[2] *Leuciscus cephalus*. *Leuciscus*, a Dace, *cephale*, the head, Gr.

THE DACE (*Leuciscus vulgaris*)

Vincent Brooks Day & Son. Lith

To face page 13.

to be left blank in the angler's diary. As a live-bait for Pike also it is especially worthy of notice, its scaling being brilliant, so as to be easily seen in thick water, and its entire appearance glittering and attractive.

This "silveryness," combined with its comparatively rounded or cylindrical conformation of body renders it a matter of ease to distinguish it at a glance from its congeners, the Roach, Rudd, and Bleak, which are all flattened at the sides, and also from the other species of the Carp family in which the colouring is either golden or bronze, or darker as in the Barbel or Tench. There is, however, one allied species, and, so to say, 'next door neighbour,' from which the non-naturalist is often easily perplexed to distinguish the Dace. When the Chub is not full grown its resemblance to the Dace is so strong that I have often known experienced fishermen at fault in determining positively whether the fish which they had caught was a large Dace or a small Chub. By bearing the following rule in mind no fisherman need ever be in doubt as to the fish he has in his basket:—The hinder margin of the anal fin of the Chub is convex, and of the Dace concave; this fin in the Dace is usually of a pale greenish white, with a very slight tinge of red—in the Chub it is of a brilliant pink colour.

In adult specimens, the size of the Chub is, of course, generally a sufficient distinction without

referring to particular marks. The whole fish moreover rapidly assumes a bronzed or golden appearance in place of the silvery tinting which the Dace retains in its original brilliancy to the last.

Between Dace and Chub, and any other fish of the same genus no comparison, as I have observed, can well arise, as all these latter (with one only exception—the Minnow) are what might be termed in one sense *flatfish—i.e.*, narrow across the back and compressed at the sides. The former, on the contrary, are plump and generally *round shaped*, so to speak, as to the body.

The Dace rises freely at the artificial fly, a small red worm being generally considered the best natural bait for it; gentles, paste, caddis-worms, &c. are, however, not unfrequently taken. It spawns about June and is exclusively a river fish.

Of the Chub as a "sporting" fish less can probably be said with truth than of its congener, but it grows to a far greater size, and from its being one of the comparatively few species of coarse fish which will take the fly kindly is worthy of more consideration from the fisherman's point of view than has often been bestowed upon it. As its specific name—the "headed dace"—implies, it is in its movements and appearance somewhat slow and clumsy, though withal, a stately and handsome fish when large and in good condition; yet I cannot but think that the fashion with old

writers of painting the Chub as a sort of water donkey must have either lacked sufficient foundation, or else that the Chub of our ancestors were somehow different from those with which we are acquainted. At any rate most of those who have tried it will probably agree as to the difficulty of filling a creel with the specimens produced by our Metropolitan river. Possibly, however, the fish of the Thames may be better educated than those of less classical streams.

For one thing I can vouch,—that a fish of quicker sight than the Chub does not swim in English waters. The slightest gleam of the rod—the shadow of the swallow flitting over his quiet corner—and down he goes like lead; so quickly, in fact, that the eye utterly fails to detect the precise movement of his disappearance or 'order of going.' Add to this extreme quickness of perception the woody nature of the haunts in which he is to be found and the fact that the successful Chub-fisher must be prepared to cast his fly to within a few inches of the boughs—often into a space the size of his hat—under penalty of losing either his fish or his tackle, and it will be conceded that the task is no easy one. In fact in this school not a few of the masters of the craft have passed their apprenticeship. To show how acute is the sight of the Chub, a gentleman who is a most successful bait-fisher on the Thames, and who recently gained a prize offered by the Piscatorial Society in con-

sequence of the heavy baskets he made, informed me that by covering his face and head with some sort of mask he was enabled to look over the edge of the bank unperceived, and could thus guide his bait into the jaws of the fish he wished to catch and watch them take it. If he attempted the same process unmasked, the Chub were instantly alarmed and ceased biting, or made off altogether.

When once hooked, and the first powerful rush for the boughs checked, the Chub seldom escapes, having remarkably tough and gristly jaws, or being as it is termed "leather mouthed."

In the earlier part of summer the fish is to be found in the sharpest and swiftest streams, into which it rushes to recover strength after the spawning exhaustion of May. In June and July it moves into deeper waters, especially below banks hung with trees or bushes, and will be there found until October or November when it takes up its winter quarters, in quiet swims, under willow beds, amongst roots, by sunken piles, or in any other cover affording good shelter.

The chocolate, almost black, tint of back and tail of the Chub are very conspicuous in the water, where indeed it often causes it to be distinguished from the dace and other fish even before it has taken the fly or bait. The lips are also peculiar in colour, being so white as (when opened) to be easily perceived at the surface, even at the distance of 10 or 15 yards.

The Chub is tolerably equally distributed throughout most parts of the United Kingdom. It is the *Penci* or *Cochgangen* of Wales, and the *Skelly* of Scotland and of the Cumberland lakes, though by no means to be confounded with the Ulswater *Schelly* or *Gwyniad*. The *Chevin* is also another local name for the Chub.

Characteristics of the Dace.—The whole length of the fish, body, head, and tail-fin being considered as 5, the length of the head alone is about as 1; depth of body about the same as length of head. Back-fin commencing half way between point of nose, and end of fleshy portion of tail. Tail-fin small and a good deal forked. Scales smaller than those of Chub, 50 in lateral line. Colour: back dark olive, or brownish green, becoming rapidly silver on the side; belly white; cheeks gill-covers and eyes silvery with a touch of bronze; pectoral and ventral-fins pale green and pink; anal-fin greenish white with a slight tinge of red; back-fin and tail-fin same colour as back.

Characteristics of the Chub.—The whole length of the fish, body, head and tail-fin being considered as 5, the length of the head alone is a little more than as 1; depth of body a little greater than length of head, which is rather blunt at the muzzle. Back-fin commencing half-way between point of nose and extremity of tail-fin, and rather nearer the tail. Tail-fin large and somewhat forked. Scales very large; 44 or 45 in the lateral line. Colour of a Thames Chub about 2 lbs. weight taken in October: Back and back of head brown. Tail-fin olive-brown with darker brown margin; back-fin olive-brown all over; pectorals bronzy olive-green; ventral- and anal-fins brilliant reddish-pink. Cheeks and *irides* golden greeny-bronze; belly silvery white, getting more golden on sides, and then golden-bronze towards the back. Margin of each scale being darker than the rest. [The sides are more silvery when the fish is young, becoming bronzed or golden as it attains maturity; the back-fin and tail-fin are also greener when young.]

THE BLEAK.[1]

THE last of the *leuciscini* or "Dace Genus" which may be considered entitled to mention amongst British sporting fish, is the Bleak, *leuciscus alburnus*,—a derivative from the Latin *albus*, white,—the "White Dace."

The Bleak is so common throughout England and in most rivers producing Roach and Dace, that a detailed description of its characteristics would be superfluous—

> "Quis non et virides vulgi solatia Tincas
> Norit, et ALBURNUS prædam puerilibus hamis?"

It may be pointed out briefly, however, that it is the only one of our freshwater fish which is in shape *narrow* as well as *flat*. Rudd, Roach, and Bream are all more or less flattened or compressed at the sides, as pointed out, but they are also broad, *i.e.*, deep—from the back to the belly, and

[1] *Leuciscus alburnus*. *Leuciscus*, a Dace, Gr.; *albus*, white, Lat.

THE BLEAK (*Leuciscus alburnus*)

To face page 144

in this particular show a striking contrast to the Bleak, which is almost sprat-like in appearance.

The term Bleak, having reference to its shining white scales, is taken from a northern word signifying to bleach or whiten, *blik* (Danish), *blick*, (Swedish and German), "glance," "glimmer." Indeed, this brilliant scalure appeared, some years ago, not unlikely to lead to its total destruction. A silvery pigment is found on the under surface of the scales, from which they derive their metallic lustre; and this colouring matter was universally used in the bead trade for imparting a pearly tint to their wares.

So great was at one time the demand, when the fashion of wearing imitation pearls was at its height, that the price of a quart measure of scales varied from one guinea to five. At one factory alone, in Paris, 10,000 pearls were issued per week; and when it is considered that each pound of scales cost the lives of 4,000 fish, and that this pound only produced four ounces of pigment, some estimate of the destruction effected amongst the Bleak may be formed. Roach and Dace, and some other fishes also furnished a colouring substance, though of inferior quality, the best of all being procured from the Whitebait.

The Bleak swims usually in large sculls or shoals, and spawns in May. In length it seldom exceeds six or seven inches, and is exclusively, so far as my experience goes, a river fish.

The following are the principal measurements, &c., of a Thames Bleak, which formed the subject of the illustration :—

The whole length of the fish, head, body and tail-fin, being considered as 6, the length of the head alone is about as 1 ; head small and delicate, and having the under jaw projecting. Depth of body at shoulder somewhat greater than length of head. Back-fin commencing nearly half-way between point of nose and extremity of tail-fin, and *much further back than the ventral fins* (in the *Dace* the back-fin commences just over the ventrals). Scales rather small and very easily detached; 52 in lateral line. Sides compressed or flattened; back very little convex; belly more convex. Colour: back, back-fin, and tail-fin, bluish-green,—[in some waters darker, and in others almost pea-green]—pectoral, and anal fins a lighter tint of the same; ventral-fins white; sides and belly shining silvery white, with a slight tint of green when held in particular lights. Eye golden yellow with a green tinge.

THE CHUB (*Leuciscus cephalus*)

OUTLINES OF ICHTHYOLOGY.

AMONGST the works of a *quasi* scientific character to which an age that is 'nothing if not utilitarian' has given birth, essays on Natural History more or less popularized have received a markedly favourable reception from the public. None of these, however,—if I except a work of my own, 'The Angler-Naturalist,' published in 1863, and now out of print,—have, so far as I am aware, been specially devoted to Ichthyology, whilst for the most part what has been written on the subject has appeared in a detached or fragmentary form,—the information furnished being either too diffuse and overlaid with technicalities to suit the requirements of the beginner, or too scanty and incomplete to be of any assistance to the more advanced student.

Thus it results that the "science of fish" is still far from being as widely understood and appreciated, as, amongst a nation of sportsmen, might have been naturally expected; and the young

angler, who would fain be also a naturalist, would probably find himself not a little perplexed in attempting to arrive, by the aid of existing manuals, at any clear general conception of a subject which, if stripped of needless difficulties and plainly set before him, he would have easily mastered.

The value to the fisherman of even a moderate acquaintance with ichthyology can hardly be exaggerated. Not only is it of the utmost practical assistance, by the insight which it affords into the habits, food, spawning-seasons, &c., of the several fish—and consequently into what are likely to be the best means of taking them—but it also doubles the pleasure of success. The most insignificant captures have to the naturalist an interest of their own, apart from their mere weight in *avoirdupois*. He is able to identify the various species he meets with, many of which would otherwise pass unrecognized, to distinguish their sexes, ages, and conditions, and to read with an intelligent eye the mysteries of this beautiful page of Nature.

In spite of the advance of Fish-science, there are still many moot points and disputed theories connected with it which require elucidation,—probably also many new varieties of fish yet to be discovered,—and it may often be within the power of the angler-naturalist to observe and accurately describe characteristics and peculiarities of the highest interest to science.

Notwithstanding, however, these inducements,

it is astonishing how many there are, calling themselves sportsmen, who are content to remain all their lives simply Killers of fish—of the habits, idiosyncrasies, and often of the specific names of which they are ignorant. This observation is even in some degree applicable to old and experienced fishermen. "Names are the representatives of things; if a man does not know the names of things in the water he may sit by it all his lifetime without gaining much information for himself, and absolutely none that he can convey to others. The alphabet of science is its technicalities; and consequently the unlearned sitter by the water is in an exactly similar position to the man who attempts to study a book without having first acquired his A B C."

Thus wrote a man who was both an enthusiastic fisherman and a thorough practical ichthyologist, and the lesson he inculcates still has its moral for (I am afraid) the great majority of anglers. To their credit be it said, however, there are very many who aspire to better things, and who have endeavoured really to qualify themselves for the name of fishermen of the first angling nation in the world.

I make no apology, therefore, for offering a few remarks on the general outlines of Ichthyology, more especially in their bearing on British sporting fish, and as regarded from the angler's standpoint.

Fishes are, in scientific phraseology, "*oviparous*

vertebrata—vertebrate animals bringing forth eggs —with a double circulation, and respiring through the medium of water." Of such vertebrata,—that is, animals possessing a backbone—they form the fourth or lowest class in the great systematic division of the Animal Kingdom; and from the fact that the salt waters alone occupy more than seven-tenths of the globe's entire surface, and are in all probability inhabited, *stratum super stratum*, as far as, or even further down than the rays of the sun can penetrate, it will readily be conceived that fish are not only the most numerous of all vertebrate animals, but must infinitely outnumber the whole of the other three classes.

In common with other animals of the same division fish possess a *continuous longitudinal nervous axis*, commonly called the "spinal marrow," situated in the centre of the spine, and composed of four parallel columns, one pair of which receive the *nerves of sensation*, coming from the surface of the body, and the other pair form the roots of the *nerves of volition*, or *action*, in connection with the muscles governing the movements of the fish. The *vertebræ*, or joints of the spine, forming the backbone, in which this nervous axis lies, are in many fishes wholly gristly, or cartilaginous, but in others more or less bony. The term "spinal column" includes both the nervous axis, or spinal marrow, and its envelope.

By an enlargement of the anterior, or more for-

ward, end of the nervous axis the brain is formed, with which the nerves of smell, sight, taste, and hearing are connected. Immediately under the spinal column, and divided from each other by their membranes, are situated the organs of respiration, circulation, digestion, excretion, and also, when it exists, the air- or swim-bladder. This type of structure is common to all vertebrate animals; but the peculiar attribute of Fishes is, that in them the function of respiration, or oxygenation of the blood, is performed through the medium of *water*, not merely temporarily, but during the continuance of life.

Duly to apprehend the various 'plans' on which fish are constructed requires a thorough acquaintance with piscine organization in all its forms. Even a condensed treatise on such a subject would necessarily occupy a volume. In the present outline, therefore, I shall only attempt to bring before the reader the general characteristics and most remarkable features, his attention being more particularly directed to those organs upon the modifications of which the classification of the various families and species, especially of fresh-water fish, is based.

The first and most important function of fish and all other animals is breathing. For the purpose of breathing fish are provided on each side of

the neck with gills (*branchiæ*, Latin), consisting of arches of bone, to which the filaments, or spongy portions, of the gills are attached, and having their surfaces covered by a tissue of innumerable blood-vessels.

Of these branchial or gill-arches, there are in fish five, of which four support the gills, the fifth being appropriated to the "dentiferous pharyngeal arch," a long arch in the throat, bearing teeth. In breathing the water is taken in at the mouth, and, after passing through the gills, is allowed to escape behind by the gill-openings. In its passage through the gills and gill filaments, the water imparts to the latter the oxygen of the air which it contains, and receives carbon in return, as in the lungs of an air-breathing animal. The gills do not decompose the water, so as to derive oxygen from it, but merely separate the oxygen from the common air contained in the water. Hence, if water is deprived of this air, or impregnated with unwholesome gases, fish cannot exist in it.

The gills also possess the power of imbibing oxygen not only from the portion of the air which is mixed with the water, but also directly from the atmospheric air itself; and this process may frequently be noticed in a vivarium, or other receptacle for fish, where the water is foul, or not changed sufficiently often, when the fish will be observed to remain for long periods together with their noses protruding out of the water. The

great majority of fishes, however, cannot continue to breathe in atmospheric air alone beyond a very limited period, as, without the aid of fluid, the leaves of the gills, or gill filaments, shortly become stuck together, when, of course, the air cannot pass between them, and they lose the power of imbibing oxygen. From this results the gasping of fishes out of water, which is the effort of nature to separate the gill filaments.

The blood is propelled to the gills by the heart, which thus answers to the right ventricle of warm-blooded animals; and from the gills it is sent to an arterial trunk, lying immediately under the backbone, forming the left or systemic ventricle of the heart, which sends the blood throughout the body.

In intimate connection with the organs of respiration occurs the question of the blood temperature.

The consumption of oxygen in all fishes is comparatively small, which may be the cause of the cold nature of their blood. The temperature of the bodies of fish that swim near the bottom is seldom more than two or three degrees higher than that of the water at its surface. In surface-swimmers a temperature of 10° Fahr. above that of the water has been occasionally found; and it may be received as a general law, that those fish which swim near the surface have a high standard of respira-

tion (and, therefore, of temperature), die rapidly on being taken out of the water, and have flesh prone to quick decomposition, and *vice versa*. Two better examples of these laws could not perhaps be given than those of the Bleak, a surface-swimmer, and the Tench, a ground-swimmer. Amongst sea-fish, Mackerel, Salmon, and Herrings may be quoted as instances of the former law, and Eels, Flat Fish, and Skate, of its converse.

With a low standard of respiration, and tenacity of life, is connected the extraordinary power exhibited by some species of sustaining extremes of high and low temperature. The Gold fish lives and thrives in water as high as 85° Fahr. Fishes exist in the hot springs and baths of various countries, ranging from 113° to 120°; and in South America Humboldt states that he saw fish thrown up alive, and apparently in health, from the bottom of a volcano, along with water and heated vapour which raised the thermometer to 210°, or two degrees below boiling point. On the other hand, in parts of Europe and North America, Perch and Eels, and several species of Carp, are not uncommonly frozen and thawed again, and even transported from place to place in a frozen state, without injury to life.

Passing to the senses with which fish are endowed, we come, as first in importance, to the sense of Sight. The eyes of fish occupy entirely

different positions in different species,—in some, such as the Skate, being placed high up, near the top of the head, and in others, as the Pike, lower down on the side of the head (the more frequent situation), their position, however, being always adjusted to suit the habits of the particular fish. The external surface of the eye itself is nearly flat, but the lens is spherical—a structure which, in a dense medium, affords the greatest power of vision at short or moderate distances, rather than a very long sight. When water is clear and undisturbed, however, the sight of fishes is very acute; and for this reason it is that a ruffled water is always preferable to a smooth one for purposes of fishing. I believe that the sight of fish in clear water is longer than is generally supposed. Standing by the side of a Scotch loch in bright calm weather I have occasionally noticed Pike basking at some not inconsiderable distance from the shore, and could plainly perceive that the observation was mutual. The fish, after apparently regarding me for a few moments, has generally backed slowly away into the deep water, disappearing so motionlessly —if I may use the expression—that the eye was hardly aware of his retreat until becoming conscious that he had vanished. Moreover it is well known that a basking Chub will sink like a stone upon the flitting of a swallow across the river; that in ponds where Carp are habitually fed by visitors, the former will follow the latter about for the ex-

pected *largesse;* and that instances have been authenticated—in several cases under my own observation—in which fish evidently recognized their keepers, as well by sight as by sound: thus clearly leading to the inference that, at any rate in many positions, when we can see the fish, the fish can see us—a hint to the fisherman worth noting.

We next come to the sense of Hearing. Much has been written at different times by clever anatomists on the subject of the sense of hearing in fish, some denying it entirely, and others asserting its existence in a greater or less degree. The former base their arguments mainly on the absence, in most species, of any external auricular orifice, and the latter upon the internal structure of the head, and practical experiment.

The probabilities of the question would appear to be with those who maintain the existence of the sense, inasmuch as fish, though generally wanting the Eustachian tube, and tympanal bones, have internal ears, or sacs which, if they do not answer the purpose of hearing or its equivalent, cannot be proved to answer any other. As instances of proved hearing in fish, Mr. Yarrell mentions that the Chinese, who breed large quantities of gold fish, call them with a whistle to receive their food. Sir Joseph Banks used to collect his fish by sounding a bell; and Carew, the historian of

Cornwall, brought his grey mullet together to be fed by making a noise with two sticks.

As regards the sense of Feeling in fish, the rigid nature of their scaly covering renders it probable that in the generality of cases they possess but little external sense of touch. Many of their members are more independent of each other than those of warm-blooded animals. They seem less connected with common centres, "in this respect," as Mr. Kirby says in his "Bridgewater Treatise," "rather resembling vegetables."

Some of their parts, such as the fins, if mutilated, can be reproduced, and, indeed, a fish, like a reptile, may be cut and almost dismembered without appearing to suffer materially. Thus the shark from which a harpoon has just dragged a portion of its flesh pursues its prey without any apparent loss of appetite or energy, and I have myself hooked the same pike with the spoon-bait three times within as many minutes.

That fish are wholly destitute of the organs of feeling must not, however, be inferred. Such organs are, indeed, to a certain extent, essential for their self-preservation. The lips in many species are soft and pulpy; the mouths of others are provided with barbules, or *cirri*—sometimes called "barbels," or "beards,"—largely supplied with nerves, and acting, doubtless, as delicate organs of touch, for detecting the nature of the substances

with which they come in contact. A remarkable instance is observable in the Gurnards, which may be said to be provided with long, flexible, sensitive fingers, to compensate for their bony lips.

It is an almost universal rule that "bearded" fish, like the Barbel and Gudgeon, obtain their food close to the ground; and these feelers appear to be given as a compensating equivalent to species which, restricted by instinct to feeding near the bottom of water that is often turbid and deep, must necessarily experience more or less imperfect vision from the deficiency of light.

Fish are subject to comparatively few diseases, probably owing to the even temperature of the medium in which they exist. They are, however, very liable to external and internal parasites, which (with the exception of those peculiar to the Salmon) generally attach themselves to sick or wounded fish.

The sense of Smell in fish is considered by most comparative anatomists to be very perfect. The nerves are large, and the extent of the membranes over which they expand so considerable that in a shark 25 feet long it has been calculated at 12 to 13 square feet.

The discrimination shown by fish in the selection and rejection of food, and the preference stated to be exhibited for certain scented oils, &c., have been adduced as arguments in favour of

their acuteness of smell. The nostrils, which are simple cavities near the end of the muzzle, divided by a membrane, are generally pierced with two holes, but both openings lead to the same common canal.

The sense of Taste is more developed in the herbivorous than in the carnivorous fishes ; but it is in general probably of a low order, as a great part of the tongue is bony, and frequently furnished with teeth, placed there for the purpose of retaining food or prey. Obliged necessarily to open and close their jaws in respiring, they cannot long retain food in the mouth when quite shut, and the substance, if of small size, must be swallowed quickly and without much mastication.

It has been thought possible, from the bony nature of the tongue and the shape of the teeth, which are calculated to assist in conveying food to the back of the mouth, that the sense of taste may reside in the soft, fleshy portions of the throat. A low sense of taste generally, however, would appear to be inferred from the fact that fish are often unable to distinguish poisonous substances, and are accordingly frequently destroyed wholesale by poachers.

In regard to the organs of digestion, the intestines of fish generally are short, and the digestive process very rapid—so rapid, in fact, in some of

the carnivorous species as to have been compared to the action of fire and water combined.

The process is most rapid, and the intestines shortest, in those species which live principally, or wholly, on animal food; and the intestines are considerably longer, and the digestion proportionably slower, in those which feed on vegetable substances. In some species, such for instance as the Grey Mullet and the Gillaroo Trout, which swallow their prey whole, the walls of the stomach are thickened so as to afford increased muscular power, and in such species the stomach has a considerable resemblance to the gizzard of a bird. The intestines and stomach differ materially in different families. The kidneys are situated under the spine.

The Brain of fishes, which is exceedingly small, is formed, as already pointed out, by an enlargement of the extremity of the nervous axis, or spinal marrow, and is disposed as in reptiles, with the addition of "nodes" or "ganglions" at the base of the nerves of smell.

The proportionate weight of brain in a Pike, as compared with its body, is as 1 to 1,300; in the Shark, as 1 to 2,500; and in the Tunny—a remarkably stupid fish—but as 1 to 3,700.

The Swimming- (or Air-) Bladder, is one of those organs which would naturally appear to be most

important in fish structure, and which is yet curiously enough absent entirely in many species. Other families have, however, under the spine, in the abdomen, an air- or "swimming"-bladder, varying in shape in the various species, which they can expand or contract at pleasure. This bladder —which is more general amongst fresh than salt-water fish—is believed to be for the purpose of enabling them to alter their specific gravity to suit the densities, at different depths, of the water in which they desire to swim or suspend themselves.

Many species, notwithstanding, though wanting this apparatus, have very nearly the same habits as those which possess it; and in some of these latter there is no external passage by which the air in the bladder can be inspired or expressed.

Some bladders are composed of a single chamber or cavity; others of two chambers, and a few of three.

Sexual Distinctions.—If we omit one or two species, such as the Tench, there are usually no very obvious external signs by which the sexes of fish can be identified—except when in spawn. The distinguishing peculiarities, however, which, with a little practice, will be found useful as guides, are as follows:—In the males, the respiratory organs, or gills, are frequently larger than in the females, and, on the other hand, the abdomen or stomach, is smaller. The males may,

therefore, often be known from the females by their somewhat sharper or more pointed muzzles, by the greater length of the gill-covers, and by the body, from the back fin downwards, being less deep as compared with the whole length of the fish.

Organs of Reproduction.—The productiveness of fish—a productiveness compared to which that of every other living creature appears insignificant—is limitless as the seas which they are for the most part destined to range. The young produced by one Cod fish at a single deposit have been found to number little short of four millions, and those of a Flounder to exceed one hundred and forty thousand.

As before stated, with but one or two exceptions, fishes are oviparous—"bringing forth eggs"—and the organs for this purpose are of the simplest possible description. As the spawning-season approaches two elongated lobes, or rolls, of roe are formed between the ribs and the intestinal canal, one on each side of the body. These, in the female, are termed *hard roe* whilst in the fish, and *spawn* after being deposited; and in the male, *milt*, or *soft roe*, in both cases.

The lobes of roe in the female consist of a vast number of separate grains, called *ova*, or eggs, partially glued together, and enclosed in a bag or sac reaching to the side of the anal aperture, through which egress is permitted at the proper time. In

the male the lobes of roe are smaller than in the female, and present the appearance of whitish fat; they remain firm until the actual spawning-season when they become gradually fluid, and are ultimately voided in small portions at a time on the abdomen of the fish being slightly pressed.

At the spawning-time, which differs in almost every species, the fish repair some to the gravelly shallows or weedy banks of rivers and others to the sandy bays of the sea. This is sometimes called "going to hill," or "roading." The female then deposits her eggs, in portions at a time, and the male presses his milt out over them; and without this impregnation, no vivification, or hatching, can take place; the eggs could never arrive at maturity.

A few unimportant exceptions to this rule exist. According to Cuvier, some species of the genus *Serranus* have each lobe of roe made up half of hard and half of soft roe, and these have been considered as being capable of producing fertile eggs without the assistance of a second fish. This may, however, be very possibly considered as a malformation rather than a natural structure. Perch, Mackerel, Carp, Cod, and some others, have been occasionally found with a lobe of soft roe on one side, and a lobe of hard roe on the other; and in these cases it is probable that the fish are prolific alone.

The female fish is in some instances attended

by two males, one on each side, so as to secure the impregnation of the greatest amount of spawn, the range of milt being immensely increased by diffusion in water.

After this process, the eggs are left amongst the gravel, or sticking to weeds or other substances, the glutinous nature of each egg supplying the means of adhesion; and when the time (which constantly varies) for the hatching of the egg arrives, the young fish breaks the shell, which has become very thin, and escapes. Artificial production—by impregnating the eggs taken from the female fish, with the milt taken from the male—is now extensively practised.

There are a few exceptions to the rule of fishes being oviparous. Amongst Sharks and Rays one or two species are viviparous, that is, producing their young alive and complete in all respects. In these fishes, which belong to the cartilaginous series, the organs of reproduction are more complicated in their structure than those of bony fish, resembling, in fact, the sexual organs in reptiles.

A few other species, again, such as the Dogfish, and some of the Rays or Skates, bring forth their young enclosed in bony cases. Their empty shells, known by the names of "mermaids' purses," "skate-barrows," &c., are frequently picked up on the sea-shore, and will be familiar to most of us, though very possibly we may not have been acquainted with their origin.

Scales: Formation and Uses.—The scales of fish are productions of the skin, each scale being attached to it by its more forward edge, which fits into a sort of pocket or "follicle;" but the manner in which the scales overlap each other is variable. Those down the side, forming the *lateral line*, are pierced in the centre with openings, to allow the escape of a lubricating fluid.

The heads of most fish also possess these openings, or orifices, usually in greater numbers than the other parts of the body; and thus the mucus or slime by which the scales of the fish are, as it were, varnished, or waterproofed, being exuded from the pores of the head is necessarily carried backwards by the current—or, in still water, by the progressive motion of the fish—and spreads itself over the whole surface of the body. The lubricating fluid is most abundant in fish with small scales, such as Eels.

Occasionally the scales are entirely covered by a soft thick cuticle, so as to be detected only by close examination.

Cycloid, *Ctenoid*, *Ganoid*, and *Placoid*[1] are the denominations of the four different kinds of fish scales. The first two of these include all the most common forms of scales, and are marked with circular or concentric lines discernible through a micro-

[1] From the Greek words *eidos*, signifying resemblance, and *cyclos*, a circle; *cteis*, a comb or rake; *ganos*, brilliancy, and *plax*, a flat, level surface.

scope, each line denoting a successive stage of growth by the addition of a fresh layer—the smallest, or top layer, having been first produced and the others added underneath.

In the Cycloids these circular lines are smooth ; whilst in the Ctenoids they are furnished with minute spiny points, or teeth, which, however, usually wear off on the disc of the scale and remain only on the posterior margin. The Ganoids have a hard, shining, enamelled surface and other peculiarities, and are found in some families of salt-water fish.

The Placoids, which lack the hard enamel of the Ganoids, are scattered over the Rays and Sharks and one or two other groups.

Modes of Propulsion.—The principal organ of motion in fishes is the tail, assisted by the simultaneous action of the fins. Progression is effected by the tail striking obliquely right and left against the water ; for which purpose the spine is constructed to bend sideways, or laterally, instead of upwards and downwards as in most other vertebrate animals.

Bones.—To give in detail an account of the bones of the different kinds of fish would occupy a volume. There are twenty-five in the head of the common Perch. Even in the case of the spine the number of vertebræ composing the spinal

column varies greatly—from sixteen, for instance, in the Sunfish (and fewer in other species) to 162 in the Conger Eel, and upwards of 230 in the Electric Eel. The shapes of vertebræ also vary, though commonly their *centra*, or bodies, are more or less narrowed in the middle like an hour-glass. The ends are cup-shaped, and the cups filled with a bag of gelatine enclosed in a strong membrane, which, being united round the rims, forms a very elastic joint.

The head in various species differs much in form, but in general consists of the same number of bones as in other vertebrate animals. Of these, the most important to the naturalist are the bones forming the gills,[1] and those constituting the jaws.[2]

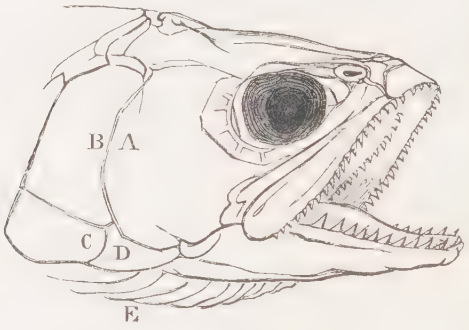
Amongst the latter the *inter-* or *pre-maxillary* forms in most fishes the edge of the front of the upper jaw, having the *maxillary* behind it. The situation of the *palatine* bones is in the roof of the mouth, one on each side of the *vomer;* and in the

[1] Opercula (from *operculum*, Latin for a lid, or cover).
Sub-Operculum.
Inter-Operculum.
Pre-Operculum.

[2] Transverse, or pterygoid.
Palatal, or palatine bones (bones of palate).
Vomer (from *vomer*, Latin for ploughshare).
Nasal.
Superior Maxillary, or maxillary (from *maxilla*, a jaw, Latin).
Inter-maxillary, or pre-maxillary.
Articular portion, &c.
Dental portion of the lower jaw, or inferior maxillary bone.

Perch both these bones and the *pterygoid* carry teeth. The lower jaw, except in the cartilaginous fishes, has generally two bones in each side: a further reference to these bones will be found under the Division "Teeth."

The relative positions of the bones composing the gill-covers, or *opercula*, will perhaps be more easily distinguished by a reference to the accompanying diagram of the head of a Trout, in which—



A represents the *pre-operculum*, or fore-gill cover.
B, the *operculum*, or gill-cover proper.
C, the *sub-operculum*, or under gill-cover.
D, the *inter-operculum*, or intermediate gill-cover.
E, the *branchiostegous* rays, or gill rays.[1]

It will thus be seen that the gill-covers consist of four pieces each:—the *pre-operculum*, or foregill-cover, A; the *operculum*, or gill-cover proper, B;

[1] From the Greek *branchia*, gills, and *stegein*, to cover.

the *sub-operculum*, or the under gill-cover, C; and the *inter-operculum*, or intermediate gill-cover, D. The three last of these are articulated, or jointed on, to the temporal bone, and play upon the *pre-operculum* (a fixed bone), A; and by the opening and shutting of these gill-covers respiration is carried on.

The form of the gill-covers is of great importance, together with the fins and teeth, in deciding the classification of fish.

The *branchiostegous* rays, or gill-rays, marked E, form a bony fan-like appendage, or fringe, to the lower margin of the gill-covers, to which they are attached.

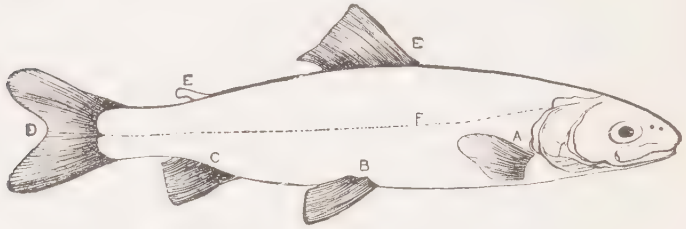
The Fins occupy a very prominent place in fish structure, not only as organs of motion but as affording by their nature, position, and number, materials for distinguishing orders, families, and genera.

The membranes of the fins are usually thin and more or less transparent, and are supported by slender bony processes, or props, called *fin-rays*, some of which are composed of single pieces, pointed at the end, designated *spinous rays*, from their resemblance to spines and thorns: and others of a number of separate pieces united by joints, and called, from their pliant nature, *soft* or *flexible rays*.

Upon this difference in structure the two leading divisions of bony fishes are founded.

The numbers of fin-rays differ entirely in various species, and, occasionally, in different individuals of the same species.

The names of the fins are derived from the parts of the body to which they are most commonly attached, as shown in the annexed diagram. They are :—



A. The *pectoral* or breast fins (so called from being placed on the breast or shoulder of the fish).

E E. The *dorsal*, or back fins.

B. The *ventral* fins (named from their position on the belly).

C. The *anal* fin (placed close behind the anal aperture).

D. The *caudal*, or tail fin.[1]

F marks the lateral or side line.

This list includes the names of all the different kinds of fins possessed by any fish, though the numbers and arrangements of them vary in almost every family,—some fish, such as the Salmon, for instance, having two dorsal fins, and others, as the Eels, lacking the ventrals altogether. The pectoral fins are considered to answer to arms or fore-legs in other animals, and the ventrals to the hinder legs; and by means of the former several

[1] These names are derived from the Latin—*pectus*, the breast; *dorsum*, the back; *venter*, the belly; *anus*, the anal aperture; *cauda*, the tail.

of the spiny-finned species are enabled to progress upon dry land, and even to travel considerable distances from one pool to another. The pectorals are supported by two bones behind the gills, one on each side, which are sometimes imbedded in the muscles, and sometimes connected with the spine, but more generally attached to the bones of the head. The ventrals are commonly attached to the sides of the belly.

The Teeth of fish are closely connected with the fins and gills, as furnishing marks by which the *sub-genera* may frequently be distinguished, and are so permanent in their characters in each species as to be well worthy of particular attention.

In different families, however, teeth differ very materially both in situation, number, and form, and also even in different species of the same family. An instance of this is seen in the dental arrangement of the several species of *Salmonidæ*, between which they furnish one of the readiest and most reliable means of distinguishing.

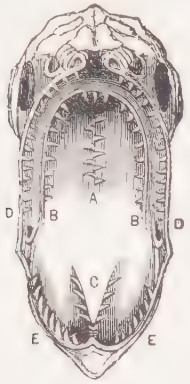
Again we find many families that are almost, if not wholly, toothless; whilst others possess teeth on all the bones which assist in forming the cavity of the mouth, and even on the bones of the throat, or *pharynx*, behind these. This latter is particularly the case in the herbivorous fishes. Sometimes the teeth are uniform in shape on the various bones of a single mouth. In

other cases they are of different patterns. The most usual form in carnivorous fish is that of a slender elongated cone, slightly curved inwards to assist in holding a struggling prey. In herbivorous fish the form is commonly that of a short rounded tubercle with a flat crown, adapted for crushing. Sometimes the teeth are so small and numerous, more especially in insect-eaters, as to have the appearance of the hairs of a brush. Occasionally they are thin and flat, with a cutting edge.

By these characteristics the habits and food of fish may usually be as readily discovered as those of graminivorous and carnivorous animals by the same means.

The "throat teeth" in the Carp, Tench, Roach, and Barbel are remarkably large, and would probably surprise most fishermen who have never examined them.

The teeth are named according to the bone upon which they are placed, as *inter-maxillary* teeth, *maxillary*, *vomerine*, *palatine*, &c. The engraving exhibits a front view of the mouth in the common Trout (*Salmo fario*), which is chosen as displaying the most complete series of teeth amongst the Salmon family.



A. Teeth on *vomer*, or central bone in the roof of the mouth.
B B. Teeth on right and left *palatine* bones.
C. Row of hooked teeth on each side of the tongue.
D D. Teeth on *superior maxillary*, or maxillary bones.
E E. Teeth on lower jaw, or *inferior maxillary* bones.

There are also in Ichthyology technical names for teeth of different shapes. The teeth commonly found in carnivorous fish, for example—slender elongated cones in form—are termed *acicular*, where stouter, *subulate*. If teeth are hair-like, and short and densely crowded, they are said to be *villiform*; if longer and equally slender, *ciliiform*; if stronger and stiffer, *setiform*, or *brush-like*; if still coarser and curved, *card-like*. When much shorter than the last-named they become *raduliform*, or *rasp-like*.[1]

Conical teeth longer and stronger than the others on the jaw are named *canines*; and those with broad flat crowns, *molars*, which is the name given to the large flat teeth of the Carp, already referred to.

[1] Yarrell's "British Fishes." J. Van Voorst.

These names take their origin from the Latin words *acicula*, a small needle; *subula*, an awl; *villus*, a fleece; *cilium*, an eye-lash; *seta*, a bristle or brush; *radula*, a scraper; *canis*, a dog; *mola*, a mill.

Fish Classification.

Fish are divided into—1. Series; 2. Orders; 3. Families; 4. Genera; and 5. Species.[1]

The two grand series of fishes consist of—

(1.) Those possessing bony skeletons, which are called *true*, or *bony fishes;* and

(2.) Those which have skeletons of cartilage or gristle, which are called *cartilaginous fishes*, or *chondropterygii*. The latter also want some bones of the jaws, and have other peculiarities.

The TRUE or BONY FISH are divided into six orders, viz. :—

ORDER I.

Acanthopterygii, or *Spiny-finned fish*. (From Gr. *acantha*, a spine, and *pterygion*, a fin.)

In this order the first portion of the back fin, or first back fin, when there are two, always has spinous rays or supports—which are also found in the anal and ventral fins.

This Order contains Fifteen Families.

The Malacopterygii, or *Soft-finned fish* (from the Gr. *malacos*, soft, and *pterygion*, a fin), furnish three Orders founded upon the *position of the ventral fins*, viz.:—

[1] Sometimes, for the sake of convenience, Families are further separated into Divisions or Sub-Divisions, and Genera into Sub-Genera.

ORDER II.

The MALACOPTERYGII ABDOMINALES, or *Abdominal Soft-finned Fish.* (From the Latin *abdomen*, the belly.)

So called from the ventral fins being attached to the abdomen, behind the pectorals, without being jointed on to the shoulder-bones.

It includes five Families, in which are the greater number of our fresh-water fish.

ORDER III.

MALACOPTERYGII SUB-BRACHIATA, or *Soft-finned Fish with lower arms.* (From Latin *sub*, under, and *brachium*, an arm.)—Named from their having the ventral fins under the pectorals, thus giving the idea of lower arms.

In this Order, which consists of three Families, the pelvis is suspended to the shoulder-bones.

ORDER IV.

MALACOPTERYGII APODES, or *Soft-finned Fish without feet.* (From Gr. *a*, a privative, and *pous*, a foot.)—Have *no ventral fins*, which, being supposed to represent feet, have thus by their absence given the designation of "Footless."

Has only a single Family.

ORDER V.

LOPHOBRANCHII, *Fish with their gills in tufts.* (From Gr. *lophos*, a tuft, and *branchia*, gills.)—This arrangement of the gills is peculiar to this Order, which, moreover, have the gill-covers entirely closed behind, with the exception of a single small hole.

Only one Family.

ORDER VI.

PLECTOGNATHI, or *Fish with soldered jaws.* (From Greek *plekein*, to bind, and *gnathos*, a jaw.)—This Order has no true ventral fins. Many of its characteristics resemble those of the cartilaginous fish. The chief peculiarity is the *maxillary* bone being soldered to the side of the *inter-maxillary*, which consti-

tutes the upper jaw—in other words, the jaw-bones being soldered together.

Two Families.

The CARTILAGINOUS FISH, or CHONDROPTERYGII (from the Greek *chondros*, cartilage, and *pterygion*, a fin), consisting of two Orders, viz. :—

ORDER I.

CHONDROPTERYGII BRANCHIIS LIBERIS, or *Cartilaginous Fish* with free gills. (From Latin *branchiæ*, gills, and *liber*, free.)—The Fish forming this Order have a single wide opening in their gills, and a gill-cover as in the Bony Fish; but no gill-rays.

The Order contains two Families.

ORDER II.

CHONDROPTERYGII BRANCHIIS FIXIS, or *Cartilaginous Fish with fixed gills*. (From the Latin *branchiæ*, gills, and *fixis*, fixed.)—These fish have their gills fixed at the outer edges, with a separate opening through which the water from each gill escapes. They have also small cartilaginous arches suspended in the muscles opposite the gills, which may be called gill-ribs.

They form two Families.

The foregoing eight Orders are again subdivided into Families, Genera, and Species, as already stated.

The following List exhibits in a tabular form the classification above explained, with the addition of the names of the various Families :—

FISH CLASSIFICATION.

SERIES I.

BONY FISHES.

Order I. ACANTHOPTERYGII.

Families.

1. *Percidæ*—the Perch family.
2. Fishes with hard cheeks.
3. *Sciænidæ*—the Maigre family.
4. *Sparidæ*—the Sea-Bream family.
5. *Mænidæ*.
6. *Squamipennes*—Scaly finned.
7. *Scombridæ*—the Mackerel family.
8. *Tænidæ*—Ribbon-shaped.
9. *Teuthididæ*—the Lancet-fish family.
10. Fishes with labyrinths in the pharynx.
11. *Mugilidæ*—the Mullet family.
12. *Gobiidæ*—the Goby family.
13. *Pectorales Pedunculati*—Fishes with "ankles" to the pectoral fins.
14. *Labridæ*—the Wrasse, or Rock-fish family.
15. *Fistularidæ*—Pipe-mouthed fishes.

Order II. MALACOPTERYGII ABDOMINALES.

Families.

1. *Cyprinidæ*—the Carp family.
2. *Esocidæ*—the Pike family.
3. *Siluridæ*—the Sheat-fish family.
4. *Salmonidæ*—the Salmon and Trout family.
5. *Clupeidæ*—the Herring family.

Order III. MALACOPTERYGII SUB-BRACHIATI.

Families.

1. *Gadidæ*—the Cod family.
2. *Pleuronectidæ*—the Flat-fish family.
3. *Discoboli*—with ventrals formed into a sucker, or "disc."

Order IV. MALACOPTERYGII APODES.

Only one Family.

Muræenidæ—Eel-shaped fishes.

Order V. LOPHOBRANCHII.

Only one Family.

Syngnathidæ—the Pipe-fish family, &c.

Order VI. PLECTOGNATHI.

Families.

1. *Gymnodontes*—with naked teeth.
2. *Sclerodermi*—with hard or granulated skin.

SERIES II.

CARTILAGINOUS FISHES.

Order I. CHONDROPTERYGII BRANCHIIS LIBERIS.

Families.

1. *Acipenseridæ*—the Sturgeons.
2. *Chimæridæ*—the Rabbit-fish family.

Order II. CHONDROPTERYGII BRANCHIIS FIXIS.

Families.

Selachi—Sharks and Rays.

Cyclostomata—Sucking-mouthed fishes.

NOTE.—It will probably assist the reader's memory to observe that when the name of a Family is derived from that of a particular species (which is considered therefore as its *type*) the technical name of that Family always ends in *idæ*, from the Greek word *eidos*, signifying "resemblance,"—as, for example, in the *Percidæ*, of which the *Perch* is the type—the *Salmonidæ*, of which the *Salmon* is the type, &c.; and that where the name is founded on peculiarity of structure or habit, the Family name describes that habit or structure, as *Gymnodontes*, with *naked teeth*, &c.

The following is a classification, according to their families, genera, &c., of fish inhabiting British fresh waters. It will be observed that with the exception of the Lampreys and Lamperns the whole of them belong to the first series, which we have seen consist of the True, or bony, fishes. The Lamperns and Lampreys belong to the second, or Cartilaginous, series of fish.

In this list I do not include doubtful species, such as the so-called Loch Leven Trout; Gold and Silver fish (the common gold fish of the *aquaria*); Golden Tench; or *Salmo Fontinalis*, and other species of an admittedly non-indigenous character, or only recently acclimatized.

In regard to the technical names of the fish, the first indicates the *genus*, and the second the species, as, for example, *Perca fluviatilis*—*Perca* representing the genus, and *fluviatilis* the species—the Perch of the river,—and so on.

1ST SERIES.

TRUE, OR BONY, FISH.

ORDER I.

Spiny-finned Fish.

Family 1. Perches—PERCIDÆ.

Species.

Perch. (*Perca fluviatilis.*)

Ruffe, or Pope. (*Acerina vulgaris.*)

Family 2. FISH WITH HARD CHEEKS.

Species.

Bullhead, or Miller's Thumb. (*Cottus gobio.*)

Rough-tailed Stickleback. (*Gasterosteus trachurus.*)
(Five other species.)

ORDER II.

Soft-finned Fish with ventral fins on the belly.

Family 1. Carps—CYPRINIDÆ.

Species.

Common carp. (*Cyprinus carpio.*)
Prussian, or Gibel, Carp. (*Cyprinus gibelio.*)
Barbel. (*Barbus vulgaris.*)
Gudgeon. (*Gobio fluviatilis.*)
Tench. (*Tinca vulgaris.*)
Bream, or Carp Bream. (*Abramis brama.*)
White Bream, or Bream-flat. (*Abramis blicca.*)
Pomeranian Bream. (*Abramis Buggenhagii.*)
Dace. (*Leuciscus vulgaris.*)
Roach. (*Leuciscus rutilus.*)
Rudd, or Red-eye. (*Leuciscus erythrophthalmus.*)
Chub. (*Leuciscus cephalus.*)
Graining. (*Leuciscus Lancastriensis.*)
Bleak. (*Leuciscus alburnus.*)
Minnow. (*Leuciscus phoxinus.*)
Loach. (*Cobitis barbatula.*)
Spined Loach, or Groundling. (*Cobitis tænia.*)

Family 2. Pikes—ESOCIDÆ.

Species.

Common Pike, or Jack. (*Esox lucius.*)

Family 4. Salmon and Trout—SALMONIDÆ.

Species.

Salmon. (*Salmo salar.*)
Bull Trout. (Grey Trout, Sewin, or Roundtail.) (*Salmo eriox.*)
Sea Trout (or Salmon Trout). (*Salmo trutta.*)
Common (or Yellow) Trout. (*Salmo fario.*)
Great Lake Trout. (*Salmo ferox.*)
Charrs.

Grayling. (*Thymallus vulgaris.*)
Fresh Water Herrings. (*Coregoni.*)
(Four species or varieties.)

ORDER III.

Soft-finned Fish having lower arms.

Family 1. Cod—GADIDÆ.

Species.

Burbot, or Eel-pout. (*Lota vulgaris.*)

ORDER IV.

Soft-Finned Fish lacking ventral fins.

Family 1. Eels—MURÆNIDÆ.

Species.

Sharp-nosed Eel. (*Anguilla acutirostris.*)
Broad-nosed Eel. (*Anguilla latirostris.*)
Snig. (*Anguilla mediorostris.*)

2ND SERIES.

CARTILAGINOUS FISH.

ORDER II.

Fish with Fixed Gills.

Family 1. Fish with mouth formed in a sucker.

CYCLOSTOMATA.

Species.

Lamprey, or Sea Lamprey. (*Petromyzon marinus.*)
Lampern, or River Lamprey. (*Petromyzon fluviatilis.*)
Fringed-lipped Lampern. (*Petromyzon Planeri.*)

To give a practical example of this classification :—The Common or River Perch is a *species* of the *genus Perca*, of the *Family* of the *Percidæ*, of the *Order Acanthropterygii*, belonging to the *True* or *Bony series* of fish ; or, in other words, is the first Species, of the first Genus, of the first Family, of the first Order, of the first Series.

In conclusion, a few suggestions for enabling the sportsman more readily to identify his fish, and for the treatment of any supposed new species or varieties, may possibly not be altogether out of place. First, then, upon the capture of any such specimen, the best and simplest course is immediately to preserve it in methylated (or common) spirit of wine—or failing these, any other strong spirit—when it can be examined and pronounced upon at leisure. Dried or stuffed fish are comparatively useless for scientific purposes. If, however, from any cause it should be found impracticable to preserve the specimen, the next best thing is a correct description in writing; and to give this with sufficient accuracy to make it of value to science—to render it, in short, such that a naturalist shall be justified in pronouncing upon it with reasonable certainty—all that is required is the clear comprehension and record in an intelligible form of a few simple facts.

The first point to be noted is the nature of the Fins—whether generally soft and flexible as in the Salmon and Carp, or hard and spiny as in the Perch: upon this it depends in which of the two principal divisions of Bony Fishes the species should be placed. This distinction is so obvious and remarkable, that when once mentioned it cannot be overlooked by the least careful observer; and as to one or the other of these divisions belongs every fish, without exception, of which the

sportsman takes cognizance, its importance is evident. The spiny-finned fishes contain fifteen Families, but no great subordinate divisions. The soft-finned fish, on the contrary, are divided into three strongly-marked Orders founded upon the position, or absence, of the *ventral fins;* and to the first of these—*malacopterygii abdominales*—belong the whole of our soft-finned *sporting* fish.

The division in which any fish is to be classed having been thus decided, it remains only to determine its family and species.

As regards family no difficulty whatever can be experienced, there being only four families in all to which it can belong, and these being clearly recognizable by the most obvious signs.

To commence with the spiny-finned fishes:—All the sporting fish of this order belong to one Family, the *Percidæ*—of which the Perch is the type; whilst those having soft fins are embraced in three families: the *Cyprinidæ*, of which the Carp is the type; the *Esocidæ*, of which the Pike is the type; and the *Salmonidæ*, of which the Salmon is the type. In regard to these families, again, no difficulty can be found, every species of the Salmon possessing the peculiar characteristic of two back fins, and no other species of the same Order more than one,—the Pike, of which we have only a single variety, being totally dissimilar from every other family,—and the remaining species

without exception belonging to the Cyprinidæ, or Carp family.

To decide with certainty between different *genera*, or different species of the same *genus*, requires a more minute observation and comparison, according to the "characteristics" which will be found appended to each. The points upon which such minor distinctions depend, and which will consequently be those to be particularly observed and noted, are :—

(A.) The *shape of the body*, which can be best ascertained by placing the fish straight on a sheet of white paper, and, when it has stiffened, carefully tracing the outline with a pencil. (B.) The relative positions of the *fins* (see p. 170); and their form, more especially as regards the back- and tail-fins, whether forked, concave, square, or convex. (C.) The form of the head and *gill-covers* (see p. 168), and their length from the tip of the muzzle to the hinder margin, as compared with that of the whole body, measuring from the tip of the muzzle to the extremity of the tail. (D.) The nature of the *teeth* and the names, if possible, of the *bones* on which they are placed (see pp. 171-174). (E.) The colouring of the body and fins of the fish, when *first caught*. (F.) The number of scales forming the lateral line. (G.) The number of *fin-rays*, or supports, in each fin.

These, in the tail fin, are counted from the first long ray outside, either above or below; and in the other fins in all cases from the first ray nearest the head of the fish.

The fin-rays are denoted, as in these pages, by placing the initial letter of the name of the fin before the numeral expressing the number of rays it contains—as D. (for "Dorsal") 9 : P. (for "Pectoral") 15 : &c. Take, for example, the fin-rays of the Gudgeon, which are particularly simple :—

D. 9 : P. 15 : V. 8 : A. 7 : C. $19\frac{6}{6}$.

Occasionally there are short incumbent rays on the base of

the tail fin, above and below the longest rays, and these are frequently omitted from the reckoning; when they are mentioned, it is in general in the shape of a fraction placed after the number of the full-length rays, the numerator denoting those above the fin, and the denominator those below it, as in the example. When there is more than one dorsal fin, the rays are enumerated with a line between them—

D. 9—12 :

the first numeral having reference to the first, or more forward, fin.

In the fish having two dorsals, as the Perch, the first is usually wholly spinous, and this is indicated as in the last case, by a line between the two numbers; when, however, there is but one dorsal, of which the fore part only is spinous, the sign + is placed between the spinous and soft rays.

This is also the rule in regard to other fins partly spiny and partly soft: thus—

(Fin-rays of Perch.) D. 15—1+13 : P. 14 : V. 1+5 :
A. 2+8 : C. 17.

Some of the soft-finned fish have an occasional spinous ray; and when this is the case their position, &c., should be fully described—a perpendicular line *after such spinous ray* being drawn in the ray formulary. Take the fin-rays of the Common Carp for example:—

D. 4/19 : P. 17 : V. 9 : A. 3/5 : C. 19.

In this instance the fourth dorsal and third anal fin-rays are spinous.

The *form of the gill-covers* has been mentioned as one of the points to be relied on for distinguishing one species from another; for whilst, owing to circumstances of food, water, or climate, different individuals of the same species will often differ widely from each other, and from their original type (in so far at least as regards those externals which most readily strike an unscientific

eye), the peculiarities of structure of the gill-cover, apparently of little moment, may, from their importance and permanence, not unfrequently indicate totally distinct and immutable species.

Any permanent and unvarying difference in the form of the head, formation of the gill-covers, and dental system, coupled with variations of colour, form, habit, or the like, which might otherwise be deemed casual, are held to constitute a distinct species.

A good example of this difference is seen in the form of the gill-covers of the Salmon and the Sea Trout—the hinder margin of the gill-cover forming in the true Salmon almost a semicircle, whilst that of the Sea Trout approaches more nearly a right angle, and both differ somewhat from the gill-covers of the Bull Trout.

CHISWICK PRESS:—C. WHITTINGHAM AND CO., TOOKS COURT,
CHANCERY LANE.